Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Taylor, E. (2016). Investigating the perception of stakeholders on soft skills development of students: Evidence from South Africa. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 1-18. Retrieved from http://www.ijello.org/Volume12/IJELLv12p001-018Taylor2494.pdf

Investigating the Perception of Stakeholders on Soft Skills Development of Students: Evidence from South Africa

Estelle Taylor
Potchefstroom Campus, North-West University, Potchefstroom, South Africa

estelle.taylor@nwu.ac.za

Abstract

Soft skills are becoming increasingly important and will be critical for success in the Information Systems profession. Employers complain about a lack in soft skills among graduates from tertiary education institutions. No agreement exists about what these skills actually are, which are of importance, and how acquiring these soft skills should be approached in higher education.

The aim of this paper is to research the perceptions of lecturers, industry, and students on soft skills development of students and to identify important soft skills that need to be developed. The paper starts with a problem statement emphasizing the importance of soft skills and the possible lack thereof. This is followed by a literature review, a description of the methodology followed for this research, the results, conclusion, and the references.

The research was done at a university in South Africa. Questionnaires consisting of open questions were distributed to lecturers, industry, and students respectively, and qualitative analysis was done on the results.

Results show that stakeholders feel that soft skills of students are not developed adequately, that there is some uncertainty about who should be responsible for developing soft skills, and that the development of soft skills is seen as a difficult task. A list is compiled of the most important soft skills according to literature, lecturers, industry, and students. This list can be used in further research on the soft skills of IT-students. Recommendations are made for the teaching and learning of soft skills.

Keywords: soft skills, higher education, information technology, industry

Introduction

Joseph, Ang, Chang, and Slaughter (2010) refer to a growing awareness that technical skills alone are insufficient for success in IT, particularly in today's dynamic, distributed, and complex workplace. A broader set of skills, beyond traditional technical skills, are required, and these are labelled soft skills. Employers complain about a lack in soft skills among graduates from tertiary education institutions (Schulz, 2008). The situa-

Editor: Gila Kurtz
Submitted: November 30, 2015; Revised: February 22, 2016; Accepted: February 27, 2016

tion is further complicated because no agreement exists about what these skills actually are, which are of importance and how acquiring them should be approached in higher education (Adomssent et al., 2007). For many years industry recruiters have been emphasizing the importance of soft kills, e.g., interpersonal communication skills and teamwork (Russell, Russell, & Tastle, 2005). The possession of soft skills is strongly associated with life and employment success (Gibb, 2014) and the realisation of importance of soft skills is on the increase (Azim et al., 2010).

According to Bancino and Zevalkink (2007) the increased demand for a broader skill set is because of the necessity for improvements to the bottom line, increasing competition, and globalization. Business executives consider soft skills a very important attribute in job applicants because soft skills are seen as critical for productive performance (Robles, 2012).

It is not enough to be academically strong; employees need to work with other cultures, communicate well, and be punctual and dependable (Gewertz, 2007). Soft skills are becoming increasingly important, and soft skills such as teamwork and collaboration, planning and leading projects, presentation delivery, and writing skills will be critical for success in the Information Systems profession (Noll & Wilkins, 2002).

The aim of this paper is to research the perceptions of lecturers, industry, and students on soft skills, and to identify important soft skills that need to be developed. The paper starts with a problem statement emphasizing the importance of soft skills and the possible lack thereof. In the literature review the terminology is defined, and a list of important soft skills is compiled. This is followed by a description of the methodology followed for this research, the results, conclusion and the references.

Problem Statement

Bancino and Zevalkink (2007) wrote that the focus of education and training is on technical topics and mathematics, science, and technical skills, yet the fast-paced, global marketplace of today is demanding more. Technical professionals in disciplines such as information technology, engineering, architecture, and research and development are increasingly required to broaden their skill sets to master the so-called soft skills.

The skills gap that has employers worried isn't the technical skills gap, but the soft skills gap. Senior management complain about the lack of soft skills in new employees and emphasize that knowledge alone is not enough to succeed, but that effective communication also influences success (Klaus, 2010). The practical importance of soft skills has been amply illustrated through research attempting to define factors related to project and project management success (Stevenson & Starkweather, 2010).

Technical skills are a part of most educational curricula, but soft skills need further emphasis in the university curricula (Robles, 2012). Douglas (2002) argues, "*...it is an accepted truism that some people who are gifted from a scientific and technical point of view find their career progress checked by their fundamental difficulties with managing people. They cannot be blamed for their lack of facility in this area, their entire training has been based around acquiring the rigorous knowledge they need to succeed at a technical level in their industry. Expecting them automatically to excel at managing people is at best naive and at worst quite unreasonable*". Employees who excel on the scientific and technical front but not on other skills such as managing and working with others will be of much less value to organizations in the future.

According to Hazzan and Har-Shai (2013) a Google search reveals that almost all problems associated with software development processes are connected to people and are rooted not in technological aspects but in the expression of soft skills. Johnston and McGregor (2004) are of the opinion that failures associated with professional services can have serious economic and human consequences and that professionals need the professional skills and attitudes involved in recognizing other perspectives and valuing diverse contributions.

From this it can be concluded that soft skills are very important and that there is a perception that recently graduated students generally lack these important soft skills. As stated earlier, the aim of this paper is to research the perceptions of lecturers, industry, and students on soft skills and to identify important soft skills that need to be developed.

The following section summarizes information from current literature on soft skills.

Literature Review

In this literature review terminology is defined, and a list of important soft skills is compiled from literature.

Terminology

Skill has always been an elusive concept. The increasing prominence of soft skills has added to this complexity (Grugulis & Vincent, 2009). The tacit nature of soft skills makes it difficult to observe and challenging to measure. There is no globally accepted definition of soft skills. Each discipline, educational sector and country defines soft skills according to their own needs (Kechagias, 2011).

Terminology being used include soft skills, applied skills and 21st-century skills (Gewertz, 2007) and practical intelligence (Joseph et al., 2010). Joseph et al. (2010) define the practical intelligence of professionals as the managerial, intrapersonal, and interpersonal skills that are used to resolve work problems. Other possible terms suggested for these skills include nontechnical skills, general skills, generic skills, essential skills, and employability skills (Johnston & McGregor, 2004); and behavioural skills (Wilhelm, Logan, Smith, & Szul, 2002). Kechagias (2011) refers to different terms being used, for instance enabling skills, generic skills, core skills, key competencies, essential skills, and necessary skills.

Although a large number of definitions may be found in the literature on the concept of skill, most emphasize that all skills are capable of being learned and developed, and involve the appropriate and observable performance of particular types of activity and tasks (Kechagias, 2011). Soft skills are defined as intra- and inter-personal skills, essential for personal development, social participation, and workplace success and should be distinguished from technical or hard skills (Kechagias, 2011). Soft skills are also defined as nontechnical skills, abilities, and traits required to function in a specific employment environment (Wilhelm et al., 2002).

Soft skills may differ, but according to Gibb (2014) they all share a common purpose and that is to improve personal development, participation in learning and success in employment. Robles (2012) writes that hard skills are the technical expertise and knowledge needed for a job while soft skills are interpersonal qualities, also known as people skills. Azim et al. (2010) refer to hard skills as processes, tools, and techniques while soft skills are seen as skills dealing with human issues or the people part of the project. Soft skills are necessary to deal with people and hard skills to analyse and predict (Azim et al., 2010).

For the purpose of this study, the term soft skills is used, and it is defined as intra- and interpersonal skills essential for personal development, social participation, and required to function in a specific employment environment.

Types of Soft Skills

Joseph et al. (2010) write about four dimensions of soft skills (or what they call practical intelligence), namely managing tasks, managing career, managing self, and managing others (including superiors, subordinates, peers, clients, etc.). There are a core set of soft skills that are common to most all programs. These are, according to Bancino and Zevalkink (2007), face-to-face communications, nonverbal communication, active listening, writing and presentation skills, self-awareness, social awareness, relationship management, conflict management, leadership, teamwork, emotional intelligence, negotiation skills, change management, and team problem solving.

Robles (2012) identified the top 10 soft skills perceived as the most important by business executives: integrity, communication, courtesy, responsibility, social skills, positive attitude, professionalism, flexibility, teamwork, and work ethic. According to Andrews and Higson (2008) the most important transferable soft skills impacting employability of graduates are professionalism, reliability, the ability to cope with uncertainty, the ability to work under pressure, the ability to plan and think strategically, the capability to communicate and interact with others, good written and verbal communication skills, information and communication technology skills, creativity and self-confidence, good self-management and time-management skills, a willingness to learn and accept responsibility. Azim et al. (2010) emphasize most of the skills already mentioned, as can be seen in Table 1.

According to Russell et al. (2005) the soft skills most frequently enumerated by industry are effective interpersonal relations, self-management strategies, teamwork, problem-solving, and decision-making. Gewertz (2007) mentions the ability to work comfortably with people from other cultures, problem-solving, the ability to write and speak well, the ability to think in a multidisciplinary way, and the ability to evaluate information critically, as well as being punctual and dependable. Another possible list is that of González-Morales, De Antonio, and García (2011): report writing, teamwork, client management and client expectations, leadership and supervision, decision making, conflict management, critical thinking, and communication of results.

From these and other sources a list of soft skills was compiled, as can be seen in Table 1. Some of the soft skills could perhaps be combined, but are kept separate here to keep true to the original source. Skills are ordered according to the frequency with which they were mentioned in the different sources, and then alphabetically.

Table 1 List of soft skills according to different sources from literature

Soft skill	**(Bancino & Zevalkink, 2007)**	**(Robles, 2012)**	**(Andrews & Higson, 2008)**	**(Azim et al., 2010)**	**(Russell et al., 2005)**	**(Gewertz, 2007)**	**(González-Morales et al., 2011)**	**(Kechagias, 2011)**	**(Casner-Lotto & Barrington,**
Communication (verbal and written)	X	X	X	X		X	X	X	X
Teamwork	X	X		X	X		X	X	X
Professionalism		X	X	X				X	X
Flexibility / ability to cope with uncertainty	X	X	X					X	
Interpersonal relations	X	X	X		X				
Leadership	X			X			X		X
Problem-solving	X				X	X			X
Responsibility / reliability		X	X			X		X	
Work ethic / Integrity		X		X				X	X
Conflict management	X			X			X		
Courtesy		X							X
Creativity			X						X

Table 1 List of soft skills according to different sources from literature

Soft skill	(Bancino & Zevalkink, 2007)	(Robles, 2012)	(Andrews & Higson, 2008)	(Azim et al., 2010)	(Russell et al., 2005)	(Gewertz, 2007)	(González-Morales et al., 2011)	(Kechagias, 2011)	(Casner-Lotto & Barrington.
Critical thinking						X	X		
Decision-making					X		X		
Negotiation	X			X					
Self-confidence			X						X
Self-management			X						X
Time-management / punctu-ality			X						X
Willingness to learn			X						X
Client management							X		
Cross-cultural relationships						X			
Emotional intelligence	X								
Handling pressure			X						
Multi-disciplinary thinking						X			
Positive attitude		X							

Development of Soft Skills

Soft skills are necessary for an individual to communicate, work as a member of a team, inspire confidence, and understand and adapt to the cultural norms of the workplace (Wilhelm et al., 2002). The nature of IT professionals' jobs are changing, and because of this job roles, required skills, and personal attributes required for successful IT employees are changing (Gallivan, Truex III, & Kvasny, 2004). Trauth, Farwell, and Lee (1993) also writes that career paths of IS professionals are changing because of restructuring of IS activities. A study by Lee, Trauth, and Farwell (1995) showed that respondents considered technical specialties knowledge to be the least important, for both now and in the future, and business functional knowledge and interpersonal/ management skills the most important in the future. IS managers with sufficient human relations and management training and who can communicate effectively remain a necessary, important but scarce resource (Trauth et al., 1993).

According to a study by Wynekoop and Walz (2000) exceptional personnel are distinguished by the following abilities:

- the ability to abstract business problems,
- creativity,
- technical and business knowledge,
- the ability to work with, and lead, teams,
- analytical and logical abilities,
- high levels of self-motivation, and
- dependability.

Graduates who intend to work in user areas require a strong background in business management and human relations. The challenge for educators and educational institutions is to change the curriculum to accommodate teaching and learning for this diversity of career paths (Lee et al., 1995). IS students can benefit from formal training / education in creative problem solving, leadership, and communication skills (Wynekoop & Walz, 2000). Even though maintaining a productive relationship with the user/client is viewed by many practitioners as the most important of skills, it apparently receives little attention in the classroom (Trauth et al., 1993).

Soft skills require a different strategy for both teaching and evaluating than other skills (Wilhelm et al., 2002). There is not a single best approach for teaching soft skills, as the most appropriate one depends on the context under which the teaching is taking place, the specific goals of the program, and the discipline (Kechagias, 2011). Hazzan and Har-Shai (2013) write that soft skills cannot be studied and taught formally and, rather, should be learned and over a period of time, based on students' engagement, active learning, and reflection.

Research by Joseph, Ang, and Slaughter (1999) showed that there is a difference between the soft skills of experienced I/S professionals and inexperienced undergraduates, suggesting that exposure to work situations is extremely important in developing soft skills. Real-world examples can also help students relate to the importance of soft skills (Bancino & Zevalkink, 2007).

Recommendations for the development of soft skills are the following (Russell et al., 2005):

- Encourage students to dialog with others by outcomes that include a short presentation, short panel discussion, or in-class Question and Answer sessions.
- Students must be required to work cooperatively with others toward a common goal.
- Instructors should strive to find learning outcomes that involve teaming, leadership, presentations, interviews, or panel discussions. Teaming builds both leadership skills and an ability to listen and follow the leadership of others.

To summarize, according to available literature, soft skills are very important, but difficult to teach. Recommendations from literature for the teaching and learning of soft skills are engagement of students, active learning, reflection, exposure to work situations, real-world examples, encouraging dialog, cooperative work with a common goal, and striving to find learning outcomes involving leadership, teaming, presentations, discussions, etc.

Methodology

Data Gathering and Analysis

The research was done at a university in South Africa. After the literature review was done, a questionnaire was created. The questionnaire consisted of open questions, and qualitative analysis was done on the results. All of the questionnaires were distributed and received back during the months October and November of 2015. Qualitative analysis was chosen because the aim was to gain a deeper understanding of the situation.

Questionnaire 1 (Industry) consisted of five questions:

- Which five of the mentioned soft skills (or others not listed) do you think are most important for IT-graduates in the working environment? List in order of importance.
- Do you think these soft skills are developed sufficiently during the students' university education?
Yes / No. Please motivate your answer.
- With which of the soft skills do graduates have the biggest problem?
- How can these skills be improved at university level – any suggestions?
- Any other comments on this topic?

This questionnaire was e-mailed to twenty-five IT companies who have previously employed our students. Twelve responses were received.

Questionnaire 2 (Lecturers) had the following additional question for each module they teach:

- List the modules you teach and indicate which soft skills, if any, are developed in each module.

This questionnaire was e-mailed to the eleven lecturers responsible for teaching and learning of IT subjects All of the lecturers answered the questions.

Questionnaire 3 (Students) had the following additional question:

- Which soft skills were developed in the program you followed (graduate and post graduate)? Indicate specific modules as well where possible.

This questionnaire was e-mailed to the thirty-nine students who have recently completed their post graduate studies in IT at the Potchefstroom Campus. Ten responses were received.

Results

In this section the results of the different questionnaires are described under the headings perception of lecturers, perception of industry and perception of students.

Perception of Lecturers

Feedback from lecturers is described under the following headings: the most important soft skills according to lecturers, the perception of the development of these soft skills, and the soft skills where the biggest shortcomings exist according to the lecturers. This is followed by a list of soft skills developed in the different subject areas that form part of the IT-program.

Most important soft skills according to lecturers

In Table 2 a list can be seen of the soft skills lecturers thought most important. Soft skills are ordered according to the frequency with which they were mentioned in the responses from lecturers. Respondents had to list the soft skills in order of importance (1-5). These rankings are also shown in the table.

Table 2 Most important soft skills according to lecturers (N = 10)

Skill	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5
Communication (verbal and written)	1	1	3	1	1	2	1	1	1	1
Work ethic	3	1	1	2	5	2	3			
Multi disciplinary thinking	5	4	5	3	5					
Self-management	4	5	3	3	2					
Decision making	4	3	5	5						
Teamwork	2	1	3	5						
Interpersonal relations	4	4	2							
Conflict management	5	5								
Eagerness to learn	3	2								
Flexibility	2	3								
Leadership	2	2								
Negotiation	4	4								
Professionalism	3	5								
Self confidence	4	2								
Client management	4									
Positive attitude	4									
Time management	4									

Perception of the Development of Soft Skills According to Lecturers

The lecturers were asked if the soft skills are developed adequately during the students' university studies. Only one lecturer answered yes. Six answered no and four were unsure. These lecturers felt that some of the soft skills are developed but not all of them.

Some interesting comments were:

"*It is the responsibility of the student to give attention to developing these skills on a daily basis"*.

"The skills are not always developed as expected because students do not always do what is expected of them".

"It is still not enough although, in my opinion, we do more than most subject groups or universities to develop these skills".

"There isn't enough time to focus on all the necessary skills".

"Most of these skills are not developed in the class room but outside of the classroom where, for instance, team work is done".

"*The size of groups has a negative impact on the development of soft skills. Not enough attention can be given to each student to develop and evaluate soft skills"*.

"Students should complete more assignments in teams. Assignments should consist of parts that are inter-dependant".

"The students grow up with the perception that it is good enough to do the minimum to pass. They should be motivated to always do their best".

Soft skills where the biggest shortcomings exist according to the lecturers

Verbal and written communication was mentioned by six lecturers and work ethics and self management by three. Team work was mentioned twice. Willingness to learn, negotiation, decision-making, client management, professionalism, and time management were also mentioned.

Interesting comments were:

"*Development of soft skills differs from student to student according to experience and maturity*".

"Students don't do what was asked of them but what they are comfortable with. They do not have the necessary respect for others. Lecturers have to make sure that students learn to follow the rules. This will help with soft skills, e.g., communication, work ethics and self management".

"Lecturers do not always have time to teach these soft skills as well as the relevant technical skills. Students can be encouraged to do short courses on soft skills".

"Maybe we should get feedback from industry and alumni to identify soft skills that are seen as problem areas. We can also use experts to present lecturers and workshops".

Soft skills being taught in the IT-program according to lecturers

Lecturers were asked which soft skills are, according to them, developed in the modules they teach. Lecturers responded for 23 different subject areas that form part of the graduate and post graduate program. Soft skills mentioned were communication (mentioned 14 times), self-management (11), teamwork (10), interpersonal relations (9), conflict management (9), leadership (6), decision making (4), work ethic (4), multi disciplinary thinking (4), professionalism (2), negotiation (2), flexibility (2), cross cultural relationships and self confidence.

Perceptions of Industry

Feedback from industry is described under the following headings: the most important soft skills according to industry, the perception of the development of these soft skills, the skills where the biggest shortcomings exist according to the industry, and suggestions from industry for improvement of soft skills.

Most important soft skills according to industry

In Table 3 a list can be seen of the soft skills industry thought most important. Soft skills are ordered according to the frequency with which they were mentioned in the responses from industry. Respondents had to list the soft skills in order of importance (1-5). These rankings are also shown in the table.

Table 3 Most important soft skills according to industry (N = 11)

Skill	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5
Communication (verbal and written)	4	4	2	5	5	1	1	2	5	1	1
Flexibility	3	1	2	4	4	4	4				
Self-management	2	5	4	1	5	4					
Teamwork	1	3	3	1	2						
Multi-disciplinary thinking	4	5	5	3	5						
Client management	3	3	2	1							
Decision making	5	4	1	3							
Conflict management	1	3	2								
Work ethic	2	2	4								
Interpersonal relations	5	3									
Negotiation	4	3									
Self confidence	5	3									
Critical thinking	2										
Emotional intelligence	2										
Professionalism	1										

Perception of the development of soft skills according to industry

Seven of the twelve respondents from industry indicated that the skills are not developed adequately at university. Three disagreed and felt that the soft skills are indeed up to standard. Two were conflicted.

Interesting comments:

"*Students who completed the post graduate year do very good to adapt to the working environment. The students we employ from your campus are definitely better than the average student from other universities. You do good work with these students".*

"Students do not learn good time management".

"Due to the nature of university most of the projects that students will work on will be pre-planned and have a set road map. Which is understandable because at the end of the day students need to be award marks for work which can be compared back to some type of standard or mark sheet. However in the work environment, requirements for projects will change, be ambiguous and be misinterpreted between parties. This results in the need for client management, negotiation and flexibility. This also results inadvertently in the potential for ethical decision like the

most common "do we let the client know about this…". It will be very hard for a university program to replicate this type of environment".

"Yes and No, I believe that a lot of the soft skills are addressed, such as communication and team work. I do however feel there is room for improvement for emotional intelligence, which is very difficult to teach and for multi-disciplinary thinking, which is often a problem for IT graduates".

"*From my experience it seems that team work and communication are well developed. The bigger problem is email communication that tends to be the lifeblood of communication in industry but most graduates prefer using whatsapp, skype and social media for communication. I however think it is industry that has to adapt here".*

"*In the industry a large part of each day is spent on communication (e-mail, meetings, etc.). The quality of this communication determines how effective your work is done. In comparison, most of your time at university is spent on own studies and assignments. Teamwork is the exception, but then all team members usually have the same background and skills".*

"No, we find well qualified individuals battling with these basic skills on an ongoing basis. Graduates are largely immature when they arrive at the workplace and a lot more can be done at university to address this".

Soft skills where the biggest shortcomings exist according to the industry

Communication was mentioned four times, conflict management and multi-disciplinary thinking three times, client management and flexibility two times, and self management, cross-cultural relationships, decision making and emotional intelligence were also mentioned. Communication in English was mentioned specifically (as our students are taught mainly in their mother tongue, Afrikaans).

Suggestion from industry for improvement of soft skills

One suggestion was that students should work in the industry during the holidays. Another suggestion was that students should work with students from other faculties.

Interesting comments were: "*IT students should get a better understanding of the industry so that they know what to expect and what will be expected from them. This will help for the preparation."*

"Give students' real world projects with real world clients or maybe try and define a project that will have change, but the change is based off the actions taken by the students".

"The challenge here is to get the individual solving the problem to think wider, evaluate the pro's and con's of more options before implementing anything, and even then to keep an open mind and not "fall in love" with the solution they selected. Get the individual tasked with finding a solution to present it to a panel that can challenge it. The more practical application experienced the better".

"*Different roles will need different skills. For a software developer decision making will be more critical while others may need multi-disciplinary thinking more. Each role has a specific communication style, for instance more detail-orientated versus more timeline-orientated".*

"I think the problem speak for itself. We have been sending new employees for elocution lessons and we have found that more often than not the very basics are missing. We find graduates from rural schools have above average ability and results at university, but when placed in a work environment the problem with communication make them introverted and stunts their growth opportunity".

Perceptions of Students

Feedback from students is described under the following headings: the most important soft skills according to the students, soft skills where the biggest shortcomings exist according to the students, and suggestions from students for improvement of soft skills. A list is also compiled of the students' perception on which soft skills were developed in different subject groups during their studies.

Most important soft skills according to students

In Table 4 a list can be seen of the soft skills students thought most important. Soft skills are ordered according to the frequency with which they were mentioned in the responses from students. Respondents had to list the soft skills in order of importance (1-5). These rankings are also shown in the table.

Table 4 Most important soft skills according to students (N = 10)

Skill	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5
Communication	1	1	1	2	1	1	1	2	1	1
Team work	2	3	1	4	4	2	1	5		
Decision making	3	5	4	3	3					
Self management	4	5	2	2	5					
Flexibility	3	5	4	3						
Professionalism	3	3	5							
Work ethic	2	5	2							
Client management	2	5								
Integrity	5	4								
Leadership	4	4								
Multi-disciplinary thinking	5	3								
Conflict management	4									
Interpersonal relations	2									
Negotiation	4									
Self confidence	3									

Soft skills where the biggest shortcomings exist according to the students

Multi-disciplinary thinking and communication were each mentioned six times. Conflict management, client management, self confidence and self management were each mentioned twice. Other soft skills mentioned were decision making, team work and flexibility.

Suggestion from students for improvement of soft skills

Interesting comments were:

"*When completing projects, combine them with other courses to give a better idea of what will happen in the industry. Example for the project subject in the 3rd year when students need to develop a website, collaborate with a design student to give a better idea on how to bring the front end and back end design together".*

"By using realistic projects scenarios – not receiving the project with all the requirements etc on paper beforehand but consulting the clients etc to discover the requirements".

Soft skills being taught in the IT-program according to students

Students were asked which soft skills are, according to them, developed during their studies. Soft skills mentioned were communication, self-management, interpersonal relations, teamwork, professionalism, decision-making, flexibility, work ethic, leadership, client management, cross-culture relationships, and conflict management.

Discussion of Results

This sections starts with a list of the most important skills according to literature, lecturers, industry and students. Perceptions of lecturers and industry on whether the soft skills are developed adequately are discussed. The soft skills listed as those where students have the biggest shortcomings are described. The section ends with suggestions (from industry and students) on how the soft skills can be improved.

List of Most Important Soft Skills According to Literature, Lecturers, Industry and Students

The important soft skills identified by lecturers, industry, and students are very similar. All of the soft skills mentioned are on the list compiled from literature (Table 1). Soft skills on the original list (Table 1) that are not mentioned by lecturers, industry, or students as most important are the following:

- Cross-cultural relationships. Cross-cultural relationships is, however, mentioned by lecturers and students as one of the skills being taught, and also by industry as one of the soft skills students are most lacking of.
- Responsibility. This could be seen as part of, and already addressed by, soft skills such as time management, self management, work ethic, etc.
- Problem-solving. This could be seen as part of, and already addressed by, soft skills such as critical thinking, multi-disciplinary thinking, etc. Also may be partly seen as a technical or hard skill?
- Courtesy. One of the lecturers made a comment about students lacking respect ("*They do not have the necessary respect for others".).* This may be seen as a reference to students lacking the skill of courtesy. This could, however, also be seen as already addressed by soft skills such as interpersonal relations, communication, conflict management, etc.
- Creativity. This could be seen as part of, and already addressed by, soft skills such as critical thinking, multi-disciplinary thinking etc.
- Handling pressure. This could be seen as part of, and already addressed by, soft skills such as time management, self management, work ethic, flexibility, etc.

Using this feedback, a list is compiled of most important soft skills according to literature, lecturers, industry, and students. This list can be seen in Table 5. Soft skills are sorted alphabetically. In columns 2, 3, 4 and 5 it is indicated whether each soft skills was mentioned by literature, lecturers, industry, and/ or students. In column 6 it is indicated whether, according to the lecturers, the specific soft skill is taught in one of the subject areas. In column 7 it is indicated whether, according to the students, the specific soft skill is taught in one of the subject areas.

Table 5 List of important soft skills according to literature, lecturers, industry and students						
Soft skill	**Literature**	**Lecturers**	**Industry**	**Students**	**Taught (according to lecturers**	**Taught (according to students)**
Client management	X	X	X	X		X
Communication (verbal and written)	X	X	X	X	X	X
Conflict management	X	X	X	X	X	X
Critical thinking	X		X			
Cross-cultural relationships	X	X			X	X
Decision-making	X	X	X	X	X	X
Emotional intelligence	X		X			
Flexibility / ability to cope with uncertainty	X	X	X	X	X	X
Interpersonal relations	X	X	X	X	X	X
Leadership	X	X		X	X	X
Multi-disciplinary thinking	X	X	X	X	X	
Negotiation	X	X	X	X	X	
Positive attitude	X	X				
Professionalism	X	X	X	X	X	X
Self-confidence	X	X	X	X	X	
Self-management	X	X	X	X	X	X
Teamwork	X	X	X	X	X	X
Time-management / punctuality	X	X				
Willingness to learn	X	X				
Work ethic / Integrity	X	X	X	X	X	X

Eleven of the twenty skills are, according to lecturers as well as students, taught in one or more of the subject areas (as can be seen from the results in Table 5). These are communication, conflict management, cross-cultural relationships, decision-making, flexibility, interpersonal relations, leadership, professionalism, self-management, teamwork, and work ethic. According to lecturers (but not students) multi-disciplinary thinking, negotiation, and self-confidence are taught. According to students (but not indicated by lecturers) client management is taught.

Soft skills that are not taught according to lecturers or students are critical thinking, emotional intelligence, positive attitude, time management, and willingness to learn. It may be argued that soft skills are also highly linked to personality types, especially emotional intelligence, positive attitude, and willingness to learn. Critical thinking should automatically be developed in any higher education program, and it is possible that it was not mentioned because this was assumed. Time management could also be seen as part of self-management.

Is the development of soft skills adequate?

Ten out of eleven lecturers answered no. Seven of the twelve respondents from industry indicated that the skills are not developed adequately at university. This shows that this is an important issue and that further research is necessary to address this.

It was good to receive some positive comments:

> *"It is still not enough although, in my opinion, we do more than most subject groups or universities to develop these skills".*
>
> "*The students we employ from your campus are definitely better than the average student from other universities. You do good work with these students".*
>
> *"I believe that a lot of the soft skills are addressed, such as communication and team work".*
>
> "*From my experience it seems that team work and communication are well developed".*

There are, however, still many areas in need of attention. This quote may be representative of most of the feedback from industry:

"No, we find well qualified individuals battling with these basic skills on an ongoing basis. Graduates are largely immature when they arrive at the workplace and a lot more can be done at university to address this".

Comments also emphasized some of the difficulties in the development of soft skills:

> *"It will be very hard for a university program to replicate this type of environment".*
>
> *"I do however feel there is room for improvement for emotional intelligence, which is very difficult to teach".*
>
> "*It is the responsibility of the student to give attention to developing these skills on a daily basis".*
>
> *"The skills are not always developed as expected because students do not always do what is expected of them".*
>
> *"I however think it is industry that has to adapt here".*
>
> *"There isn't enough time to focus on all the necessary skills".*
>
> "*The size of groups has a negative impact on the development of soft skills. Not enough attention can be given to each student to develop and evaluate soft skills".*

From the above comments it can be seen that there is a difference of opinion on where the responsibility for developing soft skills lie (student, lecturers, or industry?), and that time constraints and large groups are seen as part of the problem.

Biggest Shortcomings

Lecturers, industry, and students were asked to list soft skills where, according to them, the biggest shortcomings exist. In Table 6 the results can be seen. In the first column the soft skills from Table 5 are listed. In the second, third and fourth columns can be seen how many respondents mentioned the specific skill as a problem (if any).

Table 6. Shortcomings			
Soft skill	**Lecturers (N = 11)**	**Industry (N = 12)**	**Students (N = 10)**
Client management	1	2	2
Communication (verbal and written)	6	4	6
Conflict management		3	2
Critical thinking			
Cross-cultural relationships		1	
Decision-making	1	1	1
Emotional intelligence		1	
Flexibility / ability to cope with uncertainty		2	1
Interpersonal relations			
Leadership			
Multi-disciplinary thinking		3	6
Negotiation	1		
Positive attitude			
Professionalism	1		
Self-confidence			2
Self-management	3	1	2
Teamwork	2		1
Time-management / punctuality	1		
Willingness to learn	1		
Work ethic / Integrity	3		

Only four of these soft skills are not mentioned in any of the responses. These are critical thinking, interpersonal relationships, leadership, and positive attitude. There is a difference in the perceptions of lecturers, industry, and students on which soft skills are not developed adequately and further research is needed on this. The only soft skills on which lecturers, industry, and students agree as problem areas are client management, communication, decision making ,and self-management.

Suggestions for Development of Soft Skills

Suggestions were the following:

- Students should work in the industry during holidays.
- Students should work with students from other courses or faculties.
- Students should get a better understanding of the industry and what is expected of them.
- Students should work on real world projects with real world clients.
- Use experts to present lecturers and workshops.
- Motivate students to do their best to excel.
- More teamwork must be done; especially on projects were components of the assignment are inter-dependant.
- When students work in a team, they must assume different roles so that a student can not choose to do only that which he is comfortable with.
- Interactive lectures will help with the development of communication skills.

Conclusions

The term soft skills is defined as intra- and inter-personal skills, essential for personal development, social participation, and required to function in a specific employment environment. Available literature shows that there is a perception that recently graduated students generally lack these important soft skills. The results of this study correlates with what was found during the literature study, showing that most lecturers and respondents from the industry feel that the soft skills of the students are not developed adequately.

In the literature review many different skills were mentioned (see Table 1 for list from literature review) and sources mentioned employers being concerned about different skills not being developed as they should be. The results of this study confirm what was found in literature. Most of the soft skills mentioned were identified by the participants in this study as areas where big shortcomings exist. This shows that this is an important issue and that further research is necessary to address this.

According to available literature, soft skills are difficult to teach. This is confirmed by the results of this study showing that soft skills are seen as difficult to teach because of factors such as time constraints and large groups. This is further complicated by a difference of opinion on where the responsibility for developing soft skills lie (student, lecturers, or industry?).

Recommendations from this study for the teaching and learning of soft skills correlate with the recommendations from literature, namely that students should work in the industry during holidays (exposure to work situations), students should work with students from other courses or faculties (cooperative work), students should work on real world projects with real world clients (real-world examples), more teamwork must be done, and interactive lectures should be used to develop communication skills (engagements of students, active learning and encouragement of dialog). Other recommendations from participants in this study were using experts to present lecturers and workshops, motivating students to do their best to excel, and students assuming different roles so that a student can not choose to do only that which he or she is comfortable with.

The lists of important soft skills (Table 5 and Table 6) were compiled using the results of the literature review as well as the results of this study. The soft skills listed were client management, communication (verbal and written), conflict management, critical thinking, cross-cultural relationships, decision-making, emotional intelligence, flexibility / ability to cope with uncertainty, interpersonal relations, leadership, multi-disciplinary thinking, negotiation, positive attitude, professionalism, self-confidence, self-management, teamwork, time-management / punctuality, willingness to learn, work ethic / integrity. These lists can be used to identify problem areas that need to be addressed and to guide further research.

Future work can include larger groups of students and more respondents from industry, comparing results from participants from different institutions and other countries, and quantitative analysis (using mixed methods for richer results).

References

Adomssent, M., Godemann, J., Michelsen, G., Barth, M., Godemann, J., Rieckmann, M., & Stoltenberg, U. (2007). Developing key competencies for sustainable development in higher education. *International Journal of Sustainability in Higher Education, 8*(4), 416-430.

Andrews, J., & Higson, H. (2008). Graduate employability,'soft skills' versus 'hard'business knowledge: A European study. *Higher Education in Europe, 33*(4), 411-422.

Azim, S., Gale, A., Lawlor-Wright, T., Kirkham, R., Khan, A., & Alam, M. (2010). The importance of soft skills in complex projects. *International Journal of Managing Projects in Business, 3*(3), 387-401.

Bancino, R., & Zevalkink, C. (2007). Soft skills: The new curriculum for hard-core technical professionals. *Techniques: Connecting Education and Careers (J1), 82*(5), 20-22.

Casner-Lotto, J., & Barrington, L. (2006). *Are they really ready to work? Employers' perspectives on the basic knowledge and applied skills of new entrants to the 21st Century US workforce*: ERIC.

Douglas, M. (2002). Why'soft skills' are an essential part of hard world of business. *The British Journal of Administrative Management,* (34), 34.

Gallivan, M. J., Truex, D. P., III, & Kvasny, L. (2004). Changing patterns in IT skill sets 1988-2003: A content analysis of classified advertising. *ACM SIGMIS Database, 35*(3), 64-87.

Gewertz, C. (2007). Soft skills in big demand. *Education Week, 26*(40), 25-27.

Gibb, S. (2014). Soft skills assessment: Theory development and the research agenda. *International Journal of Lifelong Education, 33*(4), 455-471.

González-Morales, D., De Antonio, L. M. M., & García, J. L. R. (2011). *Teaching "Soft" skills in software engineering.* Paper presented at the Global Engineering Education Conference (EDUCON), 2011 IEEE.

Grugulis, I., & Vincent, S. (2009). Whose skill is it anyway? Soft'skills and polarization. *Work, Employment & Society, 23*(4), 597-615.

Hazzan, O., & Har-Shai, G. (2013). *Teaching computer science soft skills as soft concepts.* Paper presented at the 44th ACM Technical Symposium on Computer Science Education.

Johnston, S., & McGregor, H. (2004). Recognising and supporting a scholarship of practice: Soft skills are hard! In *Creating Flexible Learning Environments: Proceedings of the 15th Australasian Conference for the Australasian Association for Engineering Education and the 10th Australasian Women in Engineering Forum* (p. 68). Australasian Association for Engineering Education.

Joseph, D., Ang, S., Chang, R. H., & Slaughter, S. A. (2010). Practical intelligence in IT: Assessing soft skills of IT professionals. *Communications of the ACM, 53*(2), 149-154.

Joseph, D., Ang, S., & Slaughter, S. (1999). *Soft skills and creativity in IS professionals.* Paper presented at the Systems Sciences, 1999. HICSS-32. Proceedings of the 32nd Annual Hawaii International Conference on.

Kechagias, K. (2011). Teaching and assessing soft skills. *MASS Project, September.*

Klaus, P. (2010). Communication breakdown. *California Job Journal, 28*, 1-9.

Lee, D. M., Trauth, E. M., & Farwell, D. (1995). Critical skills and knowledge requirements of IS professionals: A joint academic/industry investigation. *MIS Quarterly*, *19*(3),313-340.

Noll, C., & Wilkins, M. (2002). Critical skills of IS professionals: A model for curriculum development. *Journal of Information Technology Education: Research, 1*(1), 143-154. Retrieved from http://www.jite.org/documents/Vol1/v1n3p143-154.pdf

Robles, M. M. (2012). Executive perceptions of the top 10 soft skills needed in today's workplace. *Business Communication Quarterly, 75*(4), 453-465.

Russell, J., Russell, B., & Tastle, W. J. (2005). Teaching soft skills in a systems development capstone class. *Information Systems Education Journal, 3*(19), 3-19.

Schulz, B. (2008). The importance of soft skills: Education beyond academic knowledge. *Nawa Journal of Communication, 2*(1), 146-154.

Stevenson, D. H., & Starkweather, J. A. (2010). PM critical competency index: IT execs prefer soft skills. *International Journal of Project Management, 28*(7), 663-671.

Trauth, E. M., Farwell, D. W., & Lee, D. (1993). The IS expectation gap: Industry expectations versus academic preparation. *MIS Quarterly*, 293-307.

Wilhelm, W. J., Logan, J., Smith, S. M., & Szul, L. F. (2002). *Meeting the demand: Teaching" soft" skills.*

Wynekoop, J. L., & Walz, D. B. (2000). Investigating traits of top performing software developers. *Information Technology & People, 13*(3), 186-195.

Biography

Estelle Taylor is a senior lecturer at the Potchefstroom campus of the North-West University in South-Africa. She obtained a PhD in Computer Science in 2008 from the North-West University. Her research focus is in Education of Computer Science and Information Systems.

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Mosharraf, M. (2016). Tuning primary learning style for children with secondary behavioral patterns. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 19-32. Retrieved from http://www.ijello.org/Volume12/IJELLv12p019-032Mosharraf2132.pdf

Tuning Primary Learning Style for Children with Secondary Behavioral Patterns

Maedeh Mosharraf
Technology-Enhanced Learning Laboratory,
University of Tehran, Iran

m.mosharraf@ut.ac.ir

Abstract

Personalization is one of the most expected features in the current educational systems. User modeling is supposed to be the first stage of this process, which may incorporate learning style as an important part of the model. Learning style, which is a non-stable characteristic in the case of children, differentiates students in learning preferences. This paper identifies a new hybrid method to initiate and update the information of children's learning style in an educational system. At the start-up phase, children's learning style information is gathered through the modified Murphy-Meisgeier Type Indicator for Children (MMTIC) questionnaire, which is based on the well-known Myers-Briggs Type Indicator (MBTI). This primary information will be tuned by tracking children's behaviors during the learning process. Analytical data mining helped us to cluster these behaviors and find their patterns. The proposed method was applied on 81 fourth grade children in elementary school. Delivering results suggest that this method provides a good precision in recognizing children learning style and may be an appropriate solution for non-stability problems in their preferences.

Keywords: Automatic detection, children learning style, hybrid method, MBTI, personality type

Introduction

Rapid development of technology has made it a necessity to provide people life-long learning facilities. Life-long learning is the "life-long, voluntary, and self-motivated" pursuit of knowledge for either personal or professional reasons (Department of Education and Science, 2000). Although eLearning systems are identified as promoters of this term in the world of education, these systems do not consider children as one important category of users. In this regard much research has been done about cognitive traits, thinking and learning process, student modeling, and personalization in eLearning systems, but in most cases, college or high school students are considered (Gong, 2014; Romero & Ventura, 2010; Truong, 2016). It seems that identification of children's modeling methods is an obvious gap in the field of eLearning.

Learning style, defined as "a description of the attitudes and behaviors which determine an individual's preferred way of learning" (Honey & Mumford, 1992, p. 1), is considered as an essential factor in the learning process and forms a part of the student model. Many educational theorists and researchers agree that in-

Editor: Gila Kurtz
Submitted: September 6, 2015; Revised: November 29, 2015; February 8, 2016;
Accepted: February 21, 2016

corporating learning style in education has potential to make learning easier for students (Ghazali, Noor, & Saad, 2015; Klašnja-Milićević, Vesin, Ivanović, & Budimac, 2011). They believe that if student learning style is not supported by teaching environments, learners with strong preferences for a specific learning style might have difficulties in learning (Felder & Silverman, 1988).

Psychologist's opinions about learning style are different and affected by several aspects. According to research conducted in 2004, 71 models of learning styles are identified and the major models based on theoretical importance and widespread uses are considered (Coffield, Moseley, Hall, & Ecclestone, 2004). Kolb's learning style model, as the most widely used learning style model, has been used frequently in psychological and educational research (Kolb, 1984). The Felder-Silverman learning style, as the second model, has a special place in engineering research (Felder & Silverman, 1988). The Myers-Briggs Type Indicator (MBTI) is one of the most applicable learning style models, which investigates learners from the cognitive perspectives (Myers & McCaulley, 1998). Since MBTI models personal characteristics of people context independently, and includes important aspects of learning, it has been used as one of the most popular learning style models.

Children's experiences of learning are too little to determine their learning style, so most of the learning style models are not applicable for them. Murphy-Meisgeier Type Indicator for Children (MMTIC) is a modified version of MBTI questionnaire introduced for children (Potts Gilbert, 1990). Unlike MBTI, there are few studies about MMTIC. One of the reasons of this issue could be related to frequent changes in children's personality, which leads to non-accurate information about their learning style after a short time. It seems that if learning management systems (LMSs) are equipped with techniques to update children's style automatically this problem could be solved.

In this paper we propose a new approach to modeling children's style statically based on a modified version of the MMTIC questionnaire. We automatically update children's profiles using behavioral logs of their interaction to eLearning system.

The paper is organized as follows. The next section starts with a brief overview on learning style modeling and introduces MBTI. The third section presents our proposed method to determine children's learning style in a LMS and tune their information automatically. Describing the provided child-specific LMS and presenting our experimental results are accomplished in the fourth section, and the final section concludes the paper and outlines future research.

Background

Personalized systems have many goals, which guide the methods of user modeling and adaptation as the two key processes of these systems. In this respect, numerous articles address the problem of student modeling in personalized learning systems (Gong, 2014). These studies can be classified according to contents of model, types of modeling process, representing model, and retrieving model (García, Amandi, Schiaffino, & Campo, 2007). In a comprehensive study, Brusilovsky (2001) proposed several attributes to apply in user models of adaptive eLearning systems. Kim, Lee, and Ryu (2013) extended these attributes as shown in Figure 1. Learning style is a component of student preferences and MBTI is one of the most used models.

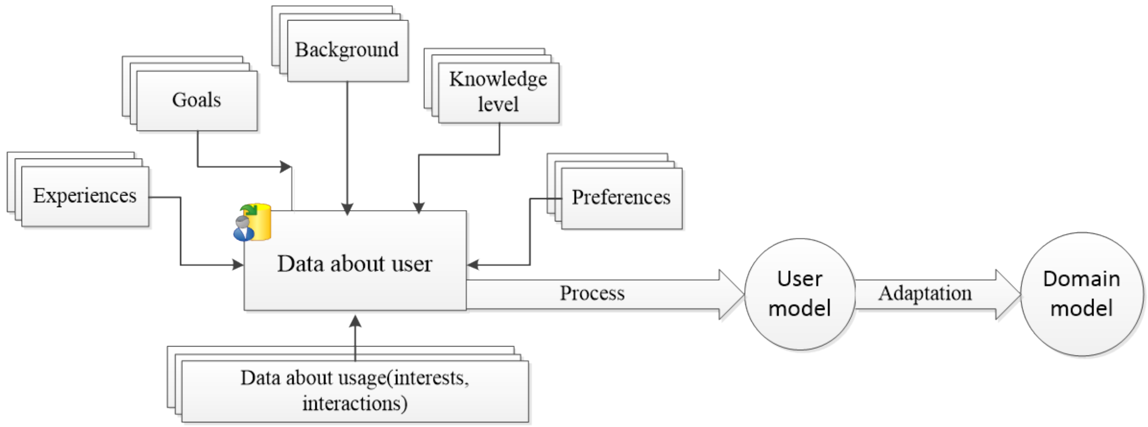


Figure 1. Elements of user model in an adaptive eLearning system, extended from (Brusilovsky, 2001; Kim et al., 2013)

Learning Style Modeling

Initiating and updating learning style information in a student model can be distinguished in two different ways (Brusilovsky, 1996): collaborative and automatic. In the collaborative approach, students provide explicit feedback, which can be used to initiate or update their information, while in the automatic one, the system uses learners' behaviors and actions. Applying a questionnaire is the easiest and common way for the first approach, whereas for the second several methods such as data mining algorithms are applied.

According to some theorists' opinions, learning styles are "flexibly stable" characteristics. In these approaches, learning styles of students are formed by their previous learning experiences and other environmental factors. Other researchers strongly relate learning styles to cognitive styles and abilities. They argue that learning styles remain stable over a long period of time. However, with respect to the life-long learning approach in eLearning systems, student learning styles are changed over time. In younger students, changes in their preferences occur with more frequency. In this respect, some researchers categorized all types of student modeling in two classes as statically or dynamically. The static student modeling refers to an approach where the student model is initialized only once. In contrast, the dynamic approaches frequently update the information of the student model (Graf, 2007).

Usually dynamic and automatic detection of learning style is based on system logs, so data mining methods play a key role in this work. For example, Özpolat and Akar (2009) use NBTree classification algorithm in conjunction with Binary Relevance classifier, which are applied on learning objects selected by students to recognize their learning style. In Chang, Kao, Chu, and Chiu (2009), a combined mechanism based on K-Nearest Neighbor classification and Genetic algorithm is proposed to classify students learning style. Dorça, Lima, Fernandes, and Lopes (2012) compare the Genetic Algorithm and Hidden Markov Model to determine and precisely adjust students' learning style automatically. They find the Markov based approach leads to more fine-tuned results than the Genetic Algorithm. Latham, Crockett, McLean, and Edmonds (2012) predict students' learning style through natural language dialogue. In this respect, they analyze the learning style models for language traits and conversational structure and adapt the generic logic rules to predict learning styles. Basheer, Ahmad, and Tang (2013) apply Multi-Agent System with the help of Ant Colony Optimization and Fuzzy Logic Search Algorithm as tools to detecting learning styles.

Myers-Briggs Learning Style

In the early l940s, Isabel Briggs Myers and her mother, Katherine Briggs developed MBTI as a test to be used for personnel selection. Myers believed that “different occupations favored different personality orientations, and that Jung’s theory provided a theoretical link between personality and job performance” (Pittenger, 1993, p. 3). Consulting Psychologists Press acquired the right to sell the MBTI in 1975, and since then, the test has been successfully marketed to an extremely wide audience. Using mental habits, methods of understanding new information, and judging styles, the MBTI distinguishes a person’s type according to four dichotomies, including (O’brien, Bernold, & Akroyd, 1998):

- Most natural energy orientation and direction of focus: Extroversion (E)/ Introversion (I)
- Perceiving function and ways of taking in information: Sensing (S)/ Intuition (N)
- Decision making and ways of coming to conclusion: Thinking (T)/ Feeling (F)
- Orientation to outer life and attitude toward the external world: Judging (J)/ Perceiving (P)

Table 1. Characteristic of MBTI personality dimensions

Dimension	**Personality characteristics**		**Dimension**
Extroversion	Thinks out loud (by talking)	Thinks privately	**Introversion**
	Being around people brings renewal and energy	Having time alone to think replenishes his energy	
	Is relaxed and confident	Is intense, bottling up emotions	
	Dislikes complicated procedures and gets impatient with slow jobs	Works on one thing for a long time	
	Is enthusiastic about activities involving action	Is hard to understand, quiet, and shy; seems deep	
Sensing	Sees the trees in the forest	Sees the forest (more global thinker)	**Intuitive**
	Handles details easily	Sees possibilities and details that others miss	
	Uses the five senses to perceive life	Uses meaning and possibility to perceive life	
	Learns best from an orderly sequence of details	Likes to have and do things differently from others	
	Is aware of environment and changes moods as physical surroundings change	Is an initiator, promoter, and inventor of ideas	
Thinking	Looks at data to decide	Decides based on personal feelings	**Feeling**
	Doesn’t need harmony, but needs fairness	Values harmony	
	Is more truthful than tactful, if forced to choose	Is more tactful than truthful, if forced to choose	
	Is brief and businesslike	Finds it difficult to be brief and businesslike	
	Finds ideas and things more interesting than people	Is more interested in people than things or ideas	
	Holds firmly to a policy or conviction	Arouses enthusiasm	

Judging	Works first, then feels a freedom to play Prefers predictability in schedule Likes things to be decided Is structured Has settled opinions	Plays first, then works Likes dealing with events as they come Likes things to remain open Is flexible Has trouble making decisions	**Perceiving**

All possible combinations of these dichotomies can occur, which result in a total number of 16 types. Table 1 describes a brief explanation of the characteristics and preferences that MBTI has identified (Behaz & Djoudi, 2012; Brightman, 2007; O'brien, et al., 1998).

Despite the numerous studies which have been done on MBTI in learning and training process, investigating MBTI as learning style in eLearning systems starts from 2000 (Dewar & Whittington, 2000). Afterwards, some research shows students with different learning styles behave dissimilarly in learning environments and with respect to learning objects (Kim et al., 2013).

The MBTI indicates not only the learners' preferences, but also clearly expresses the preferences for particular poles over their opposite. For example, Figure 2 is a summarization of typical report from Consulting Psychologists Press, the MBTI authority organization (Choi, Deek, & Im, 2008). In this example, E is showing a greater presence on a moderate level, over its counterpart, I. Similarly, in other dimensions dominant preferences are shown.

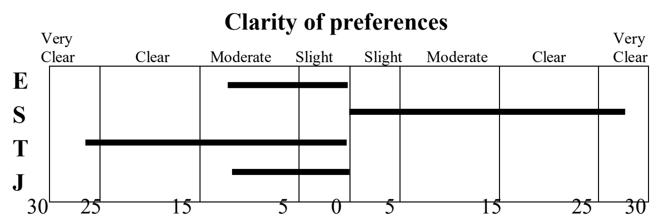


Figure 2. The strengths of MBTI type preferences

Although several versions of MBTI questionnaire are designed, they are all validated for people who are over 18 years old (Myers & McCaulley, 1998). The MMTIC is a self-report instrument designed for personality and psychological type assessment in youth aged 7-18 (Center for Application of Psychological Type, 2012). Children's lack of experience in learning activities and their learning styles non-stability have caused this questionnaire be mostly applied in learning activities instead of other domains. The dynamics of the MMTIC dimensions refer to how these four preferences interact in each individual. Like the MBTI, this questionnaire measures personality preferences on the same four sets. Both the MBTI and the MMTIC are multiple choice tests.

Incorporating Learning Style into a Child-Specific LMS

The aim of this study is investigating how learning styles can be incorporated in LMSs. Answering a psychological questionnaire is a common way for statically determining learning style. Although this method is easy and usual in learning environments, the static nature of the questionnaire makes it fault prone. Combining this static method with a dynamically driven one is the approach of this paper, which is applied to elementary school students. Receiving student's logs and pattern of their behavior, the system updates student profile information frequently.

The questionnaire describes the learning style of students at a specific point in time. Furthermore, some other problems such as misunderstanding of self-type can make the questionnaire results not reliable. In general, the questionnaire has to deal with the problem that the given answers might not correspond to the real behaviors that the questions aim to investigate.

Therefore, using a questionnaire as an instrument for identifying learning styles is based on several assumptions. The first assumption is that students are motivated to fill out the questionnaire properly and to the best of their knowledge about their preferences. Secondly, filling out a questionnaire about the preferences requires that the students are aware of their preferred way of learning. Besides, children's learning styles have not yet stabilized and may change gradually (Warner, 2000). As soon as learning style changes, the results of the questionnaire are not valid anymore and a student would have to do it again. This approach would raise new issues, dealing with how to identify an occurring change in learning style and how to motivate students to fill out the questionnaire several times.

This problem can be solved through updating information of students' learning style based on their behavior and learning preferences. Table 2 is a summary of research conducted on learning preferences in MBTI dimensions (Dewar & Whittington, 2000; Lawrence, 1993). According to this table, some behaviors of students with different learning style are various. We use all the features mentioned in this table to extract students' learning preferences in online environments.

Table 2. Learning preferences associated with dimensions of MBTI

Dimension	Learning preferences		Dimension
Extroversion	Prefers action	Considers/thinks before acting	**Introversion**
	Plunges into new experiences	Holds back from new experiences	
	Has a relatively short attention span	Spends time in thought, before and after actions	
	Eagerly attends to interruptions	Dislikes interruptions	
	Likes to work by trial and error	Prefers setting his/her own standards when possible	
	Wants to experience things so as to understand them	Asks questions to allow understanding something before	
Sensing	Prefers facts and concrete information	Prefers abstract or theoretical information	**Intuitive**
	Is realistic and practical	Is imaginative and loves ideas and possibilities	
	Going step by step	Jumps to conclusions; makes factual errors	
	Prefers memorizing to finding reasons	Has intellectual interests	
	Likes to know the "right way" to solve problems	Likes problems that require new ways of being solved	
	Enjoys using skills already learned more than learning new ones	Seems to like something new all the time	
Thinking	Contributes intellectual criticism	Is motivated by others	**Feeling**
	Wants logical reasons before accepting new ideas	Permits feelings to override logic	
	Is objective	Is subjective	
Judging	Is more decisive than curious	Is more curious than decisive	**Perceiving**
	Likes assignments to be clear and definite	Is flexible, adaptable and tolerant	
	Tries to make situations conform to his or her own standards, "the way they ought to be"	Looks for new experiences, expects to be interested	
	Aims to be right	Aims to miss nothing	

We expect that the students' preferences in online learning environments to be same as the offline ones. So, we track behaviors of students in learning management systems and update their information models based on the extracted patterns that relate to learning style dimensions. But, for solving the cold start problem at the start-up phase of the system – not knowing the learner's profile – we use a personality indicator questionnaire. Figure 3 illustrates the process of our proposed method.

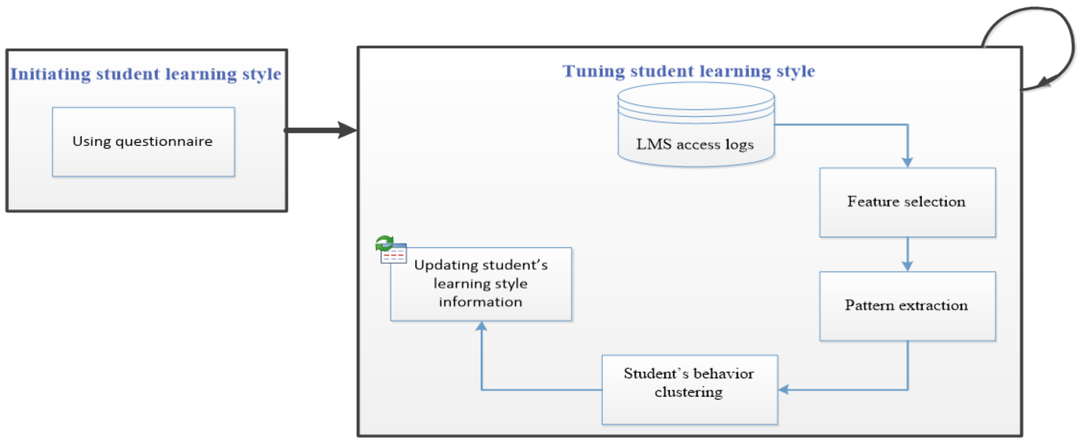


Figure 3. The process of tuning primary learning style with learner access logs

A. Initiating Student Learning Style: Static Determination

To identify the learning style of children at the starting-up of the system, we use the child personality indicator questionnaire. This questionnaire is a modified version of MMTIC that is translated to Persian language and localized based on some linguistic and cultural aspects. This test, which contains 70 questions about children preferences, is approved by a panel of psychology and pedagogy experts as discussed in a previous paper (Mosharraf, Taghiyareh, & Kharrat, 2013). The children personality indicator questionnaire is a self-reporting instrument in which a child is asked to choose between two preferences, neither of which is wrong. Same as MBTI and MMTIC, the four measured preferences in this test are E/I, S/N, T/F, and J/P. Test scores can range from one extreme to a contrasting extreme and each pole of the dimensions has different characteristics. Children scores can be any number in the spectrum of two poles.

B. *Tuning Student Learning Style: Automatic Determination*

As soon as a child's learning style changes, the results of the questionnaire may not be valid. To tune information of children's learning style, we use the new automatic method, which is based on tracking children's behaviors. In our proposed method, no additional effort is needed on the students' side in order to enable the system to get information about their learning styles. In this regard, students interact with the LMS only for learning activities, but the system monitors their behavior simultaneously. At arbitrary times, LMS administrators can check system access logs. If students' behaviors are recognized as contrary to the determined learning style stored in their model, information of student model should be revised. For this purpose, some data mining techniques are applied to students' access logs to extract behavioral patterns of each student.

In online environments, learning behaviors regarding the patterns are clustered based on selected features extracted from Graf (2007). Considering children limitations in the LMSs, these features include:

- Learning contents
- Outlines
- Examples

- Assessments
- Exercises

Regarding different features, the number of visits and the duration students spend on these objects are used as their behavioral patterns. Learning preferences, which are mentioned in Table 2, corroborate this claim. Occurrence frequency of learning patterns that is used in any learning style dimensions is context sensitive and affected by course subject. Therefore, we use the behavior of students to determine thresholds of each pattern. For this purpose, we cluster all the children's behaviors in three categories: low, middle, and high.

The category of learning patterns which is labeled "high" is matched to one style dimension. For example, sensing learners favor concrete materials like facts and data, so they prefer to learn from examples. Therefore, a high number of visited examples and time spent on them may be indicants of sensing style. On the other hand, intuitive learners prefer to learn from abstract materials such as theories and their underlying meaning, so they probably choose to learn from content objects. A high number of visited contents and time spending on them can be demonstrators of initiative style. Furthermore, sensing learners like to solve problems in accordance with a standard procedure, which can be indicated by a high interest in examples. In these students, multiple reviews in examples are done to see and learn existing approaches and a high number of assessments and exercises are conducted in order to check the acquired knowledge. Regarding Table 1 and Table 2, sensing learners are more patient with details and work carefully, but slowly. With respect to the preference for working slowly, the times taken for visiting examples, assessments, and exercises are considered as a pattern. However, intuitive learners tend to be more creative. Therefore, they are expected to be better in answering questions about developing new solutions, which requires the understanding of underlying theories and concepts. In contrast to sensing students, intuitive learners like challenges.

Research shows gender differences in feeling/ thinking dimension of MBTI and this issue has caused students' behaviors to become unpredictable in different contexts (Dewar & Whittington, 2000). In addition, both perceiving and judging types indicate an appreciation for online learning environments, but extracted patterns of them are not valid for children. According to O'brien et al., (1998) sensing/ intuitive dimension is proposed as the dimension with most differences in learning behaviors. Because of the importance of group learning, the introvert/ extravert dimension is also important. Therefore, we study only two dimensions in this paper: E/I and S/N. Kim et al. (2013) verified that E/I and S/N dimensions are the most dominant functions of the MBTI in learning behaviors. Table 3 summarizes all the selected features that are available in children learning behaviors.

Table 3. Selected features of learning behaviors related to learning style dimensions

Features	Pattern	Pattern Description	E/I	S/N
Outline	OutlineVisit	Number of visited outlines	U	N
	OutlineStay	Percentage of time spent on outlines	I	N
Content	ContentVisit	Number of visited content objects	I	N
	ContentStay	Percentage of time spent on content objects	I	N
Example	ExampleVisit	Number of visited examples	U	S
	ExampleStay	Percentage of time spent on examples	I	S
Assessment	AssessmentVisit	Number of performed self-assessment questions	E	S
	AssessmentStay	Percentage of time spent on self-assessment tests	I	S
	AssessmentRetry	Number of retry for assessment	E	S
Exercise	ExerciseVisit	Number of performed exercises	E	S
	ExerciseStay	Percentage of time spent on exercises	E	U

In the above table: "U" is the acronym of "Undefined".

In addition to the number of visits and duration students spend on learning objects, the pattern of navigation for each learning style dimension is different (Anohina, Vilkelis, & Lukasenko, 2009; Graf, 2007). For example, thinking students like to analyze and solve the practical exercises using course knowledge. So, the navigation plan of these students is usually the sequence of contents, examples, and then exercises. On the other hand, feeling students use practical exercises to be familiar with course subject; therefore, their navigation plan is exercises, examples, and contents (Bachari, Abdelwahed, & Adnani, 2010). Table 4 indicates the patterns of navigation in the E/I and S/N dimensions of learning style. All the patterns of student navigation, which are the sequential subset of any presented navigation in this table, can be applied to determine learning style.

Table 4. Navigation pattern related to learning style dimensions

Learning style dimension	Navigation pattern
I	Learning contents, Assessments, Exercise
E	Assessment, Exercise, Learning content, Example
S	Example, Learning content, Assessment, Exercise
N	Exercise, Learning content, Example

Although each dimension of learning style has specified patterns, some of them may yield conflicting results. As Table 3 shows, one relevant pattern of IN students is OutlineStay, but for IS students this object can be a contradiction. For solving this problem, we use students' scores in each dimension of learning style that are obtained by the questionnaire. Like frequency of learning behaviors, we divide the scores of each learning style dimension in three groups as weak, moderate, and strong (presented in Table 5). A weak style is considered as undefined. Considering dominant style, if the indicants of weak style in one dimension and strong style in the other are gathered in a child, we expect the strong style to dominate. In other cases, learning style is undefined. When conflict occurs in some features and learning style becomes undefined, the system uses other learning features to resolve this conflict. In the mentioned instance, OutlineVisit or ExampleVisit can be determiner of learning style.

Table 5. Segmentation of learning style scores

Score range	Learning style
0 – 30	Weak
30 – 70	Moderate
70– 100	Strong

Experimental Results

One of the main difficulties of research about children is encouraging them to effectively participate in all the research stages. In addition, children's education should be done in special environments. For example:

- Children's motivation for engaging in learning activities (Gagne & Deci, 2005);
- Effect of operative feedback and interactive learning environment (Mosharraf & Taghiyareh, 2012);
- Limited children's working memory and profitable user interface for system (Wang, Li, & Shi, 2007);
- Children's curiosity and fantasy-driven nature (Asgari & Kaufman, 2004).

Providing some arrangements to obtain these conditions was one of the first steps in this research. To this end, we implemented a learning management system for children (Mosharraf, Taghiyareh, & Nasirifard, 2013). The Child-specific LMS provides all the proposed features which are identified in Table 3. In order to investigate learners' behaviors, the learning materials are distinguished according to the proposed features. In addition, for some features, an additional description of the material is specified. For example, with the aim of distinguishing between contents and outlines, we extend our implemented LMS by including the possibility of using meta-data for teachers and course developers to specify information about the created learning materials.

A. Extensions Regarding Questionnaire Results

The proposed approach for defining children's learning style was examined on fourth-grade elementary school children. For this purpose, 81students were asked to respond to the prepared questionnaire. This process was done when a student logged in to the system for the first time. Table 6 shows the results of children styles obtained by the questionnaire.

Table 6. Questionnaire result of learning style

Learning style dimension	Min	Max	Median	Std Deviation
E/I	22.2	88.9	44.4	17.1
J/P	-27.8	22	11	14.7
S/N	-77	66.7	-11	36.8
T/F	-25	25	0	19.9

We normalize all the children's scores in each dimension of learning preferences to (-100, 100) as E/I, J/P, S/N, and T/F. As Table 6 shows, all the examined children are extravert. This issue can be relevant to children's conditions at an early age and their tendency to be in a group of friends. The achieved scores for J/P and T/F dimensions are less than 30 for all of the students, which lead to weak preferences in these dimensions. One reason for this may be relevant to inappropriate perception of children from these dimensions of their personality. The recorded scores in the S/N dimension show high diversity of the examined children. Children's distribution is seen in all the three strong, moderate, and weak groups in intuition preferences. But, the sensing children are located in moderate and weak groups.

B. Extensions Regarding Behavioral Tracking

Tracking children behaviors in learning environments can help the system to respond to children's preferences when they change and always deliver personalized services to them. Students' access logs in LMS make it possible. The LMS logs of children's interactions in biology context and creatures' course was used for our research. Collected data set contain 169,908 records related to 23 days of student training.

The time-consuming step in detection of children's style was data cleaning and outlier removing. Using obtained data, we calculated the number of visited learning objects and the time spent on them for each child. After that, we applied K-Means algorithm on each of the learning features, which are mentioned in Table 3, separately and divided the children in three groups based on their behaviors. So, we used the information of this table to determine the expected style for all of the behaviors that are labeled "high".

In order to determine learning style of children based on their navigation pattern, we used ApprioriAll algorithm (Agrawal & Srikant, 1995). This algorithm is applied on all the features of Table 4. But, the low support and confidence in the extracted sequences make these features to be not valid.

To evaluate the effectiveness of our hybrid method to detect the children's style, we compare the result of the proposed automatic method with questionnaire as a common approach in learning style modeling. We expect the results of both methods to be same after short time duration. Automatic detection of children's style was done 17 and 23 days after answering the questionnaire. Since these time durations are short, it is expected that the children's styles are not changed significantly. Therefore, calculating the precision of our method needs to use some measures. We define the precision of automatic method as:

$$\text{Precision}=\frac{\sum_{i=1}^{n} Sim(LS_{\text{automatic}},\ LS_{\text{questionnaire}})_i}{\text{n}}.\ 100, \quad (1)$$

Where LS $_{\text{automatic}}$ refers to the learning styles diagnosed by our automatic method. Also, LS $_{\text{questionnaire}}$ represents the learning styles indicated by the prepared questionnaire, and n is the number of all the students. The function Sim compares its two parameters LS $_{\text{automatic}}$ and LS $_{\text{questionnaire}}$ and returns 1 if both are equal. Table 7 shows the precision of the implemented system in automatic detection of children's style.

Table 7. System precision

Time duration	Extravert / Introvert (E/I)	Sensing / Intuitive (S/N)
17 days	56.79%	72.84%
23 days	69.14%	80.24%

The important restriction in our system evaluation is the low time interval between the static and automatic tests. Since the style of children can change repeatedly, the time interval between the two tests should be low. However, this short interval leads to few students' access logs which may be not enough for extracting their patterns. We hope that as time passes and more children's data is collected this will lead to detecting better patterns of their behaviors; the results of the system tend to the reality.

The proposed automatic detection of children's style is focused on only two dimensions of their learning style. According to the mentioned results in Table 7, this method has shown an acceptable similarity in the S/N dimension. Considering the problem of a questionnaire as a static method for determining children's learning style, our results in automatic method can be acceptable even in the E/I dimension. Due to our achievements, diagnosing the E/I dimension of learning style based on children's behavioral patterns in an online learning environment needs more access logs. However, we need to focus on learners' behaviors on the other dimensions and not rely only on the questionnaire results. It seems this method can accelerate learners' modeling process, which is a time-consuming procedure in adaptive learning processes.

In the automatic method, we assign all the learning preferences of children in the E/I and S/N dimensions to learning objects and find their appropriate behaviors. Accomplishing these assignments in the T/F and J/P dimensions needs more research on the children's preferences and learning behaviors. As shown in our study, perception of children in these dimensions is weak. So, investigating this issue can face many troubles.

Conclusion

In this paper we concentrated on learning styles of children considering the life-long learning approach. Since the learning experiences in children are too little to gain the accurate perception of their style, we used personality type instead. For initiating primary information of children's learning style, a modified version of the MMTIC questionnaire was used. The questionnaire results showed almost all of the children are extravert, but in absorbing information they can be sensing or intuitive. Also, it seems that children do not have any strong preferences in the perceiving/ judging and thinking/ feeling dimensions.

For solving the non-stability problem of children's learning style, we used access logs of the system in order to tune the children's model. In this regard, we applied clustering algorithm on extracted behavioral patterns of children. Regarding learning preferences which are compatible to each cluster, children's information can be tuned. Experimental results show this method has an acceptable precision in diagnosing children's learning style.

Although tuning the student models is done based on automatic approach, it does not work fully automatically. Pre-processing steps including data cleaning and outlier removing are case sensitive. In addition, some analyses are context based and need human opinions. Due to these restrictions, it would be very useful to improve eLearning systems with automatic data mining methods. In addition, the experimental results show children's navigation plan cannot be applicable in the case of learning style detection. However, this feature may be used in other age classes. Furthermore, there are two aspects of MBTI, perceiving/ judging and thinking/ feeling, which our results did not find good criteria for categorizing children at this age, but we believe they may be more effective in older students. All the findings and prototypes developed in this paper can be used as the basis for further research and developments regarding providing advanced adaptivity in LMSs.

References

Agrawal, R., & Srikant, R. (1995). *Mining sequential patterns.* Proceedings of the Eleventh International Conference on Data Engineering. Taipei.

Anohina, A., Vilkelis, M., & Lukasenko, R. (2009). Incremental improvement of the evaluation algorithm in the concept map based knowledge assessment system. *International Journal of Computers, Communications & Control, 5*, 6-16.

Asgari, M. & Kaufman, D. (2004). *Relationships among computer games, fantasy, and learning.* Vancouver.

Bachari, E. E., Abdelwahed, E. H., & Adnani, M. E. (2010). Design of an adaptive eLearning model based on learners personality. *Ubiquitous Computing and Communication Journal, 5*, 1-8.

Basheer, G. S., Ahmad, M. S., & Tang, A. Y. C. (2013). *A conceptual multi-agent framework using ant colony optimization and fuzzy algorithms for learning style detection.* Kuala Lumpur, Malaysia.

Behaz, A. & Djoudi, M. (2012). Adaptation of learning resources based on the MBTI theory of psychological types. *IJCSI International Journal of Computer Science Issues, 19*, 135-141.

Brightman, H. (2007). *GSU Master Teacher Program: On learning styles.* Accessed 8 April 2012 from http://www2.gsu.edu/~dschjb/wwwmbti.html

Brusilovsky, P. (1996). Methods and techniques of adaptive hypermedia. *User Modeling and User-Adapted Interaction, 2*, 87-129.

Brusilovsky, P. (2001). Adaptive hypermedia. *User Modeling and User-Adapted Interaction, 11*, 87-110.

Center for Application of Psychological Type. (2012). MMTIC: *Essential materials*. Accessed 5 August 2013 from http://www.capt.org/catalog/Personality-Assessment-Children.htm

Chang, Y.-C., Kao, W.-Y., Chu, C.-P., & Chiu, C.-H. (2009). A learning style classification mechanism for e-learning. *Computers & Education, 53*, 273–285.

Choi, K. S., Deek, F. P., & Im, I. (2008). Exploring the underlying aspects of pair programming: The impact of personality. *Information and Software Technology, 50*, 1114–1126.

Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004). *Should we be using learning styles? What research has to say to practice*. London: Learning and Skills Research Centre, University of Newcastle upon Tyne.

Department of Education and Science. (2000). *Learning for life: White paper on adult education,* Dublin: Stationery Office.

Dewar, T. & Whittington, D. (2000). Online learners and their learning strategies. *Journal of Educational Computing Research, 23*, 415-433.

Dorça, F. A., Lima, L. V., Fernandes, M. A., & Lopes, C. R. (2012). Automatic student modeling in adaptive educational systems through probabilistic learning style combinations: A qualitative comparison between two innovative stochastic approaches. *Journal of the Brazilian Computer Society, 19*, 43–58.

Felder, R. M., & Silverman, L. K. (1988). Learning and teaching styles in engineering education. *Engineering Education, 78*, 674–681.

Gagne, M., & Deci, L. E. (2005). Self-determination theory and work motivation. *Journal of Organizational Behavior, 26*, 331–362.

García, P., Amandi, A., Schiaffino, S., & Campo, M. (2007). Evaluating Bayesian networks precision for detecting students learning styles. *Computers & Education, 49*, 794–808.

Ghazali, A. S. M., Noor, S. F. M, Saad, S. (2015). *Review of personalized learning approaches and methods in e-learning environment*. International Conference on Electrical Engineering and Informatics (ICEEI), Denpasar.

Graf, S. (2007). *Adaptivity in learning management systems focussing on learning styles.* Austria: Unpublished doctoral dissertation, Vienna University of Technology.

Gong, Y. (2014). *Student modeling in intelligent tutoring systems.* PhD dissertation, University of British Columbia.

Honey, P., & Mumford, A. (1992). *The manual of learning styles* (3rd ed.). Maidenhead: Peter Honey.

Kim, J., Lee, A., & Ryu, H. (2013). Personality and its effects on learning performance: Design guidelines for an adaptive e-learning system based on a user model. *International Journal of Industrial Ergonomics,* pp. 450-461.

Klašnja-Milićević, A., Vesin, B., Ivanović, M., & Budimac, Z. (2010). E-Learning personalization based on hybrid recommendation strategy and learning style identification. *Computers & Education*, 56, 885–899.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development* (Vol. 1). Englewood Cliffs, NJ: Prentice-Hall.

Latham, A., Crockett, K., McLean, D., & Edmonds, B. (2012). A conversational intelligent tutoring system to automatically predict learning styles. *Computers & Education, 59*, 95–109.

Lawrence, G. (1993). *People types & tiger stripes* (3rd ed.). New York: Center for Applications of Psychological Type.

Mosharraf, M., & Taghiyareh, F. (2012). *Improving student success rates through a semi-personalized feedback system.* Groningen, s.n.

Mosharraf, M., Taghiyareh, F. & Kharrat, M. (2013). *Equipping children elearning systems with a hybrid personality type indicator*. Shiraz, s.n.

Mosharraf, M., Taghiyareh, F. & Nasirifard, P. (2013). Developing a child-centred LMS to enhance learning and creativity of students in elementary school. *Bulletin of the IEEE Technical Committee on Learning Technology*, *15*, 10-13.

Myers, I. & McCaulley, M. (1998). *Manual: A guide to the development and use of the Myers-Briggs Type Indicator.* Palo Alto: Consulting Psychologists Press.

O'brien, T., Bernold, L., & Akroyd, D. (1998). Myers-Briggs type indicator and academic achievement in engineering education. *International Journal of Engineering Education, 14*, 311-315.

Özpolat, E., & Akar, G. (2009). Automatic detection of learning styles for an e-learning system. *Computers & Education, 53*, 355–367.

Pittenger, D. J. (1993). Measuring the MBTI...and coming up short. *Journal of Career Planning and Employment, 54*, 48–53.

Potts Gilbert, A. (1990). *Master thesis: A comparison of the Murphy-Meisgeier Type Indicator for Children and the Myers-Brigs Type Indicator.* Ohio: Graduate School of the Ohio State University.

Romero, C., & Ventura, S. (2010). Educational data mining: A review of the state of the art. *EEE Transaction on Systems, Man, and Cybernetics—Part C: Applications and Reviews, 40*, 601-618.

Truong, H. M. (2016). Integrating learning styles and adaptive e-learning systems: Current developments, problems and opportunities. *Computers in Human Behavior*, *55,* 1185–1193.

Wang, T., Li, X., & Shi, J. (2007). *An avatar-based approach to 3D user interface design for children.* Charlotte, s.n.

Warner, S. (2000). *The effects on student's personality preferences from participation in Odyssey Of The Mind.* Morgantown, West Virginia: PH.D thesis: College of Human Resources and Education at West Virginia University.

Biography

Maedeh Mosharraf is a Ph.D. candidate at the Technology-Enhanced Learning Laboratory at University of Tehran. She received her B. Sc. and M. Sc. in Information Technology engineering from University of Tehran in 2010 and 2013, respectively. During these years, she has been involved in a variety of research works like new Information Technology Applications, Web-Based Educational Systems, Technology-Enhanced Learning, and Psychological Theories, as well as open educational resources combined with semantic web technology, which has been covered in her Ph.D. thesis.

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Goumas, S., Symeonidis, S., & Salonidis, S. (2016). Greek nursery school teachers' thoughts and self-efficacy on using ICT in relation to their school unit position: The case of Kavala. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 33-55. Retrieved from http://www.ijello.org/Volume12/IJELLv12p033-055Goumas2208.pdf

Greek Nursery School Teachers' Thoughts and Self-Efficacy on using ICT in Relation to Their School Unit Position: The Case of Kavala

Stefanos Goumas, Symeon Symeonidis, and Michail Salonidis
Business Administration Department, Technological Educational Institute of Eastern Macedonian and Trace, Kavala, Greece

goumas@teiemt.gr, simsymeon@yahoo.gr, mdsa86a@gmail.com

Abstract

The purpose of this research is the exploration of the opinions and level of self-efficacy in the usage of Information Communication Technologies (ICTs) of teachers in Greek pre-schools in the learning process and administration of nurseries. By using the term "usage and utilisation of ICTs in the learning process" we mean the utilisation of the capabilities that new technologies offer in an educationally appropriate way so that the learning process yields positive results. By using the term "self-efficacy" we describe the strength of one's belief in one's own ability to use the capabilities he or she possess. In this way, the beliefs of the person in his or her ability to use a personal computer constitute the self-efficacy in computer usage. The research sample consists of 128 pre-school teachers that work in the prefecture of Kavala. Kavala's prefecture is a representative example of an Education Authority since it consists of urban, suburban, and rural areas. The approach that is deemed to be the most appropriate for the exploration of such research questions is content analysis methodology and correlation analysis. The main findings of the study have shown statistically significant differences regarding the opinions and stances of the pre-school teachers for the introduction of the ICTs in the administration and the usage and utilisation of ICTs in the administration and preparation of teaching. Lastly, there were statistically significant differences between the opinions and stances of the pre-school teachers for the usage and utilisation of ICTs in the learning process. Instead, there were no statistically significant differences regarding the level of self-efficacy of the pre-school teachers in the usage and utilisation of the ICTs in the learning process. The research results could be used in the educational field as well as by Greek Ministry of Education, Research and Religious Affairs in order to take any corrective action, after the effort of Greek Ministry of Education, Research and Religious Affairs, to integrate ICT in the learning process with training courses since 2006.

Keywords: ICT, educational process, use & development of ICT, self-efficacy

Introduction

In the last decade, a very broad debate has been launched on the integration of new technologies in the educational process and how it benefits students and also teachers both in cognitive and educational level (Jimoyiannis, 2008). Although teachers acknowledge the im-

Editor: Gila Kurtz
Submitted: October 21, 2015; Revised: January 12, 31; February 7, 21, 2016: Accepted: February 20, 2016

portance of the usage of Information Communication Technologies (ICTs) in teaching practice, they seem reluctant to apply them in their daily teaching practice; when using them they apply them as teaching assistance means (for example, collection of information from the internet, worksheets in word, PowerPoint presentations) and not as a meaningful learning tool (Jimoyiannis, 2008).

One of the factors that hinder the integration of ICTs in the educational process is the inability of teachers to utilise them pedagogically. It seems that the training that enhances their knowledge about the handling of these instruments and cultivates the technical skills of the learners is not enough for their use as learning tools (Jimoyiannis & Komis, 2006; Sim & Theng, 2007).

One would therefore expect that after training on the didactic use of ICTs according to one's specialty, things would change radically. But such a change did not happen. Surveys in various educational disciplines have shown that even after the completion of the B-Level Informatics training of teachers program, they continue to use new technologies as a tool or with the traditional teacher-centered way (Passa, 2010, Trapsioti, 2010). Also, studies have shown that, although the programs that were carried out have had positive results on the use and utilisation of ICTs in the learning teaching process, they remained in the presentation rather than the practical side. This is something that both trainers and the trainees agree with (Mainas, 2009; Zetta, Papaconstantinou, & Apostolidis, 2009).

Theoretical Framework - Clarification of Conditions

The current study makes use of the terms "usage and utilisation of ICTs in the learning process" and "self-efficacy." By using the term "usage and utilisation of ICTs in the learning process" we mean the exploitation of the capabilities that new technologies offer in an educationally appropriate way so that the educational and learning process yields positive results (EAITY, 2009). By using the term "self-efficacy" we describe the strength of one's belief in one's own ability to use the capabilities one possess (Bandura, 1997, referring to Kassotakis & Roussos, 2006). In this way, the beliefs of the person in his or her ability to use a personal computer constitute self-efficacy in computer usage (Kassotakis & Roussos, 2006). According to international researchers, self-efficacy plays an important role in the development of computer abilities and in one's decision to use them (Compeau & Higgins, 1995). The degree of self-efficacy in an individual's computer use can be measured with appropriate scales.

Literature Review

There exist quite a few studies regarding the pre-school usage and utilisation of ICTs. Lovari and Charalambous (2006) realised that the usage of ICTs in the process of teaching and learning can increase the knowledge and the interest of pre-school aged kids in learning in comparison to conventional means of teaching. In addition, through the results of this research it is obvious that teaching ICT skills can start from the pre-school age when this happens through games and creative activities. Furthermore, Gialamas, Zaranis, and Tsara (2009) have shown that in general Greek female pre-school teachers form a positive opinion regarding the usage of technology as a means of teaching and learning of mathematical concepts by kids in the pre-school age.

Goti and Ntinas (2010) attempted to record the change of opinion of teachers for the usage of PCs in nurseries throughout a period of time. Studying the findings it can be seen that for a period of twelve years (1998-2010) the presence of PCs in the direct environment of the pre-school teachers is not restrained anymore and that its usage is wider. The vast majority of the nursery teachers agree with the inclusion of PCs in the preschool classes. The integration will positively affect the development of the mental and the creative imagination field, the development and cultivation of oral and written skills as well as mathematical thinking. By using the PCs in the classroom the individual pace of the child is respected. The authors' realization that the nursery that took part in the study encounter the PCs positively and wishes to use them is probably related to the training they received during the last years. The results of the study of Christodoulou-Gliaou and Gourgiotou (2009) have shown the positive stances of all nursery school teachers in the utilisation of the PCs in the learning process in the nursery school under the following conditions: the teachers should be continuously trained; they should have the appropriate logistical infrastructure and also the appropriate educational software. Petrogiannis (2010) found that after the new curriculum of the Greek Ministry of Education, Research and Religious Affairs was introduced there is still an important proportion of nursery teachers that do not have any experience of PC usage either in general or for educational purposes. Furthermore, it was found that the level of the knowledge of PCs that the nursery school teachers have has a positive effect on their stance towards technology and the perspective of integrating ICTs in the pre-school classes. On the other hand, Oikonomidis and Zaranis (2010) realised that the pre-school teachers encounter PCs more as a means of executing bureaucratic tasks and preparing their teaching rather than as an educational tool that is used during the educational process. In other words, they perceive PCs as independent devices without knowing the wider abilities as part of ICTs. These results can be explained mainly by the limited knowledge of the pre-school teachers for ICT and its usage in the school environment. Finally, the study by Kolerda, Sarafidou, and Spyridakis (2013) has shown that the vast majority of studies for the relationship between the Director of the nursery and the ICTs is oriented to the influence of the Director of the nursery in teaching and application of ICTs in the school unit and not in the degree of improvement of management skills of himself/herself in ICT towards a proliferative offer throughout the educational community (students, parents, teachers, supervisors). However, it was found that the need for very good knowledge and familiarity with ICT in the School Unit Director is immediate and dire. On the other hand, with what might be expected, this positive predisposition of teachers is not accompanied by relevant educational activity, which is most evident in the educational workers of the Kindergarten. The existence of the computer does not imply use (Papadimitriou, 2013) or, as rightly stated by O'Donnell, ICTs were introduced at school but fail to be part of the classroom (Papadimitriou, 2013).

By reviewing the recent studies it turns out that the nursery teachers modify their perspective and stance regarding the usage of new technologies in the nursery by passing from the denial and cautious stage to a positive approach. It seems that "the nursery school teachers understand the dynamics of technology, understand that their position and role is not in danger and by no means the dynamics of knowledge does decrease but in contrary the adoption of new mechanisms and production methods enhances and stabilizes their position" (Ntinas, 2010, p. 15) What triggered the choice of this particular research topic was the question of what happens in the specialty of nursery teachers and the realization, after conversation with colleagues of several specialties, that despite the teachers' training for the educational utilisation of ITCs, many of them still use the new technologies as an auxiliary tool; that is either as a presentational and projectional tool or as an information searching tool, worksheets in word, notes, or tests.

Purpose of this Research – Research Questions

For the above mentioned reasons it is important to explore the opinions and stances of the level of self-efficacy of the pre-school teachers in Greece in the usage and utilisation of ICTs in the learning process and nurseries' administration. To achieve this goal we will seek answers to the following research questions:

1) How does the entrance of ICTS in the administration of the nursery schools affect the opinions of the pre-school teachers for ICTs?
2) How does the utilisation of ICTs in the administration and preparation of teaching affect the opinions of the pre-school teachers for ICTs?

3) How does the usage and utilisation of the ICTs in the administration of the nursery schools relate to the stance of the pre-school teachers for ICTs?
4) How does the usage and utilisation of ICTs in the learning process relate to the level of self-efficacy of the pre-school teachers?
5) How does the usage and utilisation of ICTs in the learning process relate to the position that the pre-school teachers hold in the school unit?

Limitations of Research

The sample of the study is not representative, as it is deemed to be small as it focuses on one region. Therefore it is impossible to extend the results to the general population of nursery teachers. However, a clear picture of the Greek nursery teachers has been given. For the study of the research questions a quantitative research has been designed. A qualitative methodology could offer a different perspective to these research questions. In particular, a qualitative approach could deepen in the subjects under study and give a different dimension to the subject.

Research Methodology

Participants

In this research, the participants were 131 nursery school teachers in the Primary Education Authority in the prefecture of Kavala. The sample of the study comprise of nursery school teachers and managers of single or multiple teacher nursery schools. We used a simple random sampling with a representative sample from the whole prefecture of Kavala (equal spread of urban, suburban, and rural areas). The prefecture of Kavala constitutes a representative example of an Education Authority since it consists of urban, suburban, and rural areas. The collection of the data from the general population of the Greek educators was impossible due to the size, cost, available time, and access inability.

We therefore collected data from a smaller team, which was a subgroup of the general population, so that the sample can be representative of the studied population (L. Cohen, Manion, & Morrison, 2008). In order for the sample to be representative, the determination of the minimum number of participants was based on the principle that for the detection of a mean difference between two independent samples we need 64 participants in each group with an estimation error of 5% at a 95% level of significance (J. Cohen, 1991).

The prefecture's nursery teachers consisted of women aged 28-56 years old with work experience of 4-32 years in education. Finally, permission was requested and granted by the Education Authority and the nursery school teachers for conducting the study and their participation in it.

Research Plan

During the conducting of the research we adopted the approach of quantitative study and in particular the method of comparing the means of two independent groups in order to answer our research questions. We tested the means between the data that were collected from two different teams of teachers. The first group was comprised of pre-school teachers and the second group was comprised of pre-school teachers that hold the position of the manager in the nursery school. The reason behind the choice of the managers as objects of this study was their dual role in the school unit (teachers but also administrative and educational foremen/forewomen). Another reason for this choice was the responsibilities they bear for the qualitative upgrade and adjustment of the school unit that they manage to the new data of the educational process. In addition, their beliefs and plan of action are of vital importance for the formulation of the general policy that the school they manage will adopt.

In particular, we studied whether there is a difference in the mean of the two groups between the opinions and level of self-efficacy concerning ICTs and the usage-utilisation of ICTs in the teaching and administration of the nursery school. The quantitative approach was chosen by using the personal preference and the familiarisation of the researcher with it but above all to the goals and questions that were set. This method was preferred since it is appropriate for the study of questions that regard the "how" of the phenomena (L. Cohen et al., 2008) and also is an economic way of collecting and analysing data for both the resources and the time constraints.

Dependent Variables

In the current research the dependent variables are the introduction of ICTs in the administration of the nursery schools and the usage and utilisation of ICTs in the learning process and administration.

Independent Variables

In the current research the independent variables are the opinions, the stances, the teachers' level of self-efficacy concerning ICTs and the position they hold in the school unit.

Data Collection Tool

As a data collection tool for the quantitative research we chose a questionnaire; such a method is relatively not expensive and has the ability to collect the answers of a large number of respondents. When creating the questionnaire a serious concern was the type of questions to be asked, the sequential order of the questions, and the creation of measurement scales. The Likert-type measurement scale was chosen with five possible answers in order to avoid neutral responses. The reason that we chose not to include a neutral answer to the biggest part of the questionnaire was in order to avoid the accumulation of such responses and thus facilitate the distribution of responses to negative and positive. The questions were of closed-end type. The design of the questionnaires was based on the Kartsioti and Roussos questionnaire (2010), which involved the construction of a psychometric measurement tool for the computer usage by teachers in teaching. The questionnaire was also based on the questionnaire by Kassotakis and Roussos (2006), which involved the construction of a Greek scale for the self-efficacy in computer use. We made the necessary modifications to make it suitable for the data collection that we wanted. The researcher also borrowed some ideas by a Vasileiou's and Mikropoulos' (2005) similar paper. (See the Appendix for a copy of the questionnaire.)

Finally, the researcher, by sending a cover letter, informed each teacher quickly and accurately for the research in which he/she will participate and emphasized the importance of their participation in order for them to respond responsibly and gave guidance on how the questions should be answered. Also, special attention was paid to the wording of the questions, with the help of a pilot research, so that the necessary improvements could be done in order to make it absolutely clear that the questions are easily understood.

Reliability and Validity

In order for the conclusions that were drawn from the data analysis of the questionnaire to be valid, it was necessary that the available data measured precisely the elements of interest and were directly related to the purpose and questions of the research. This concern was taken seriously into account during the planning of the questionnaire. So for this purpose we used the apparent validity of alternative survey methods, which means that an attempt was made to investigate the extent to which the questionnaire "appears" to measure what it claims to measure.

For the above mentioned reason, the questionnaire under investigation was distributed to non-specialist readers and their opinion was asked. This was done because it has been proven, as Zafeiropoulos (2005) mentions, that “a questionnaire that shows an apparent validity convinces the respondent for its value, consistency and purpose, therefore it is answered with fewer problems regarding refusals, resentment of the respondent, etc.” (page 122).

Because the apparent validity appears to be of minor importance in comparison to other forms of validity (Zafeiropoulos, 2005), an attempt to control the content validity was made so that the questions meet and adequately describe the content of the phenomenon that the questionnaires were to investigate. Finally, there was a correlation between the scale we created and a corresponding one measuring similar features (convergent validity). For the above reason, along with the scale we made, we provided the scale used for a similar study by Kassotakis and Roussos (2006) and Kartsioti and Roussos (2010).

However, there were some factors that were impossible to control and, therefore, could have shaken the validity and reliability of the measurements. Therefore, the accuracy of the responses and the honesty of the respondents cannot be ensured. For this reason and with the help of the pilot survey we used the internal consistency reliability in order to evaluate the homogeneity of the scale’s questions. The scale was applied only once; for the responses the Cronbach's alpha coefficient was used which was a=0.78, with an acceptable limit being a = 0.70. The reliability of repeated measurements was also used in order to evaluate the stability of the responses. For this purpose the scale was applied twice to the same person under the same conditions at an interval of one week and a correlation of the two scores, was calculated which was found to be r = 0.77, with an acceptable limit of the coefficient (Pearson’s correlation coefficient) to be r= 0.70. Lastly, the representativeness of the sample is not altered, as there was a very high response rate since only 3 out of 131 respondents were absent.

Procedure

The conduct of the research was focused on the Kavala prefecture. The population concerning the investigation was the nursery school teachers of the Primary Education Authority of Kavala. The procedure adopted for the research consists of the following stages.

a) The first stage, August 2014, was the selection of the sample on which the research was conducted. More on the selection of the sample was mentioned in the previous paragraph.

b) After the creation of the questionnaire, December 2014, and for checking of the apparent validity, the questionnaires were distributed to non-specialised readers and their opinion was asked, January 2015.

c) After checking of apparent validity done a pilot study, March – April 2015. A pilot study was conducted in a small portion of the sample. The initial questionnaires were given for trial to seven trained teachers who could check for errors, ambiguities, etc. Problems such as the wording of the questions were addressed before the questionnaires were in their final form and ready for distribution.

d) After the pilot study, distribution of the questionnaires to individuals of the sample, May 2015. The interviewer, after getting permission from the Education Authority, sent out the questionnaires electronically to nursery schools asking the permission of the nursery school teachers. For each questionnaire the first page constitutes a cover letter which includes information about the survey, instructions for completing the questionnaire; it also stresses the importance of the participation of the respondent in the survey. This last part was expected to increase the probability of response from the participants whilst the clear instructions contribute to the validity of the research (Javeau, 2000).

e) Collection of completed questionnaires, May 2015. Participants were given a deadline of two weeks to complete the questionnaire which is considered a long enough period so that they don't feel pressed to respond. Finally, the researcher collected the completed questionnaires via Google drive.

Data Processing

The processing of the data obtained was done with the statistical package SPSS v20. In the first part of the analysis the descriptions of each variable were presented. The data were depicted by appropriate tables and charts so that the profile of the participants and their responses could be outlined in order to be easily perceived by the researcher and the reader. Then the data analysis was conducted by using statistical inference. For each group, the sample averages were calculated and then for the study of the relationship we applied a T - test for independent samples; however, we first checked that the data from both groups were drawn from populations that were normally distributed and had equal variances. The critical value for a two tailed test of statistical significance level $\alpha = 0.05$ and the appropriate degrees of freedom (df) was found and compared to the t value; then the results were assessed whether they were statistically significant (Emvalotis, Katsis, & Sideridis, 2006; (Roussos & Tsaousis, 2011). Finally, the conclusions were drawn based on the data so that the questions set could be answered.

The questionnaires were assigned a serial number and were encoded. The questions were numbered for each part of the questionnaire separately and so it was easy to present the results in tables. The scales (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree, also, never, rarely, more than once a month, more than once a week, every day and too much, enough, a bit , not at all) received the following values: strongly disagree = 1, disagree = 2 neither agree nor disagree = 3, agree = 4, strongly agree = 5. The next scale was never = 0, rarely = 1, more than once a month= 2, more than once a week = 3, every day = 4 and respectively too much = 4, a lot = 3 Fairly = 2 Bit = 1 None = 0.

By using these scales, the frequencies of responses and the average of responses were calculated (Javeau, 2000). To facilitate the processing, the data from the questionnaires were encoded. Then we created a worksheet with the encoded data in which each row corresponded to an individual questionnaire (participant) and each column to a question or sub-question.

Results of the Questionnaires' Processing

Results of the Demographics of the Questionnaires

The sample of the survey consisted of 128 teachers. Their average age was 43.68 with standard deviation of 6.86. The whole sample was consisted of women. Concerning the level of their studies, as shown in the diagram in Figure 1, the majority of the participants (82.98%) have a second degree and 17.02% are master's holders.

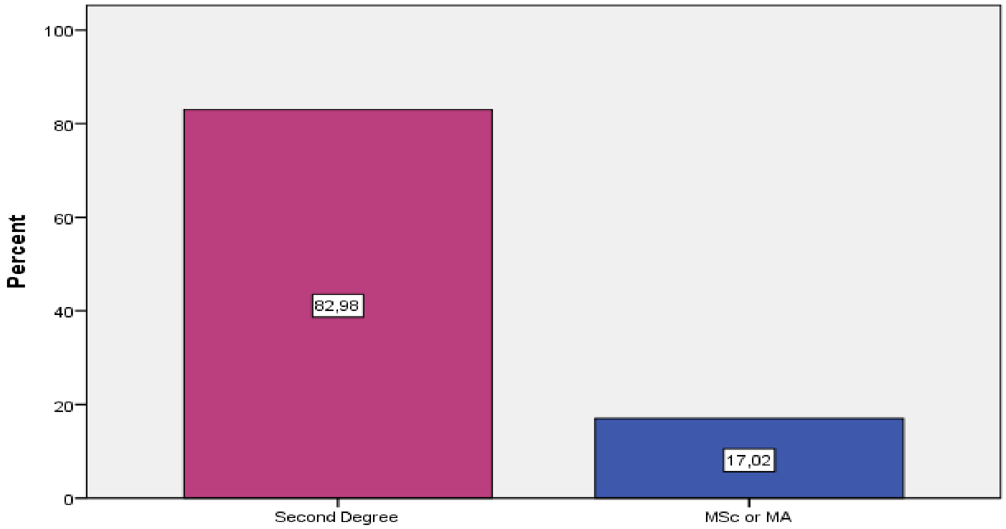


Figure 1. Diagram of the distribution of the survey respondents with respect to their level of studies

Regarding the educational experience of the teachers, the average employment experience was 16.07 with a standard deviation of 6.85. In addition, 43.8% hold managerial positions (Head / Director) and 56.2% do not, as shown in the diagram in Figure 2.

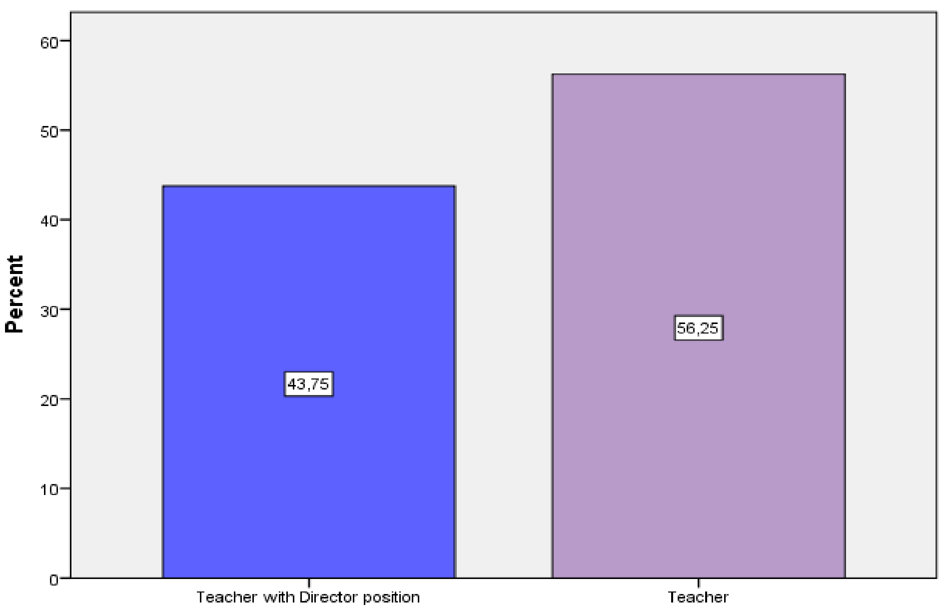


Figure 2. Diagram of the distribution of the survey respondents with respect to the position they hold in their service

Regarding the area of the school 42.19% of the schools are in urban areas, 33.59% are in suburban and 24.22% are in rural areas, as shown in the graph in Figure 3.

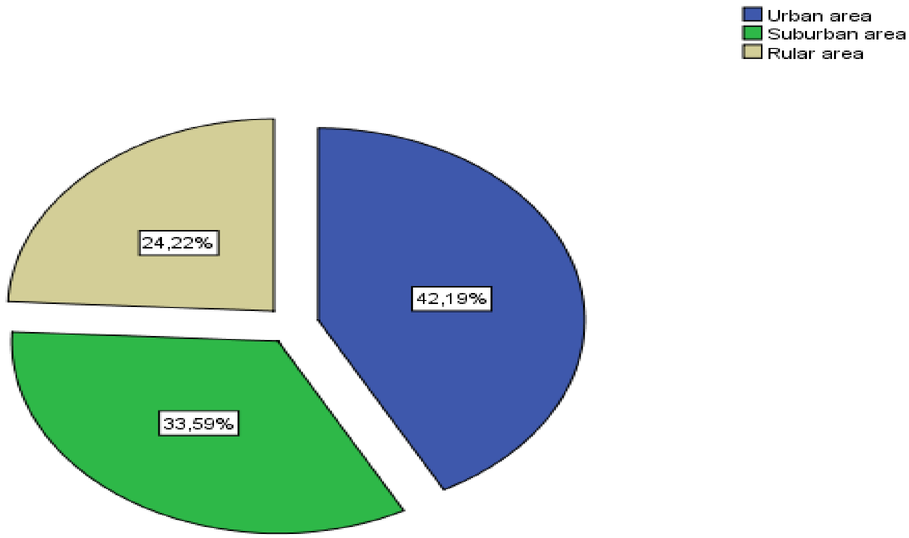


Figure 3. Pie chart of the survey respondents with respect to the school's area

Analysis of the Responses with Respect to the Position They Hold (Administrative or Otherwise) in the Nursery School Compared to the Components of Research

The components of the survey are:

- Entry of ICTs in the management of the nursery schools,
- Utilization of ICTs in the management and preparation of the teaching practice,
- Investigation of the stance of the participants towards the use and utilisation of ICTs in the management of nursery schools,
- Investigation of the self-efficacy of the teachers in the use and exploitation of ICTs in the learning process,
- Investigation of the extent of use and exploitation of ICTs in the learning process of a nursery school.

All the above are components of the study "investigation of the opinions, stances, and the level of self-efficacy in ICTs of the Greek nursery school teachers in the usage and the utilisation of ICTs in the learning process and the administration of nurseries." The position that the teachers held (administrative or not) was studied in relation to the components of the research: introduction of ICTs in the management of nursery schools, usage of ICTs in the management and preparation of teaching, investigation of the stances of the participants in the usage and utilisation of ICTs in the management of nursery schools, the exploration of the self-efficacy of teachers in the use and utilisation of ICTs in the learning process, and finally to investigate the degree of use and utilisation of ICTs in the learning process of a nursery school.

Relationship between the Opinions of Nursery School Teachers in the Introduction of ICTs in the Management of Nursery Schools and the Position (Administrative or Not) They Hold

To investigate the relationship between the position and the opinions in the introduction of ICTs in the management of nursery schools the data were analysed by using the T - test for independent samples (administrative position, not an administrative position). The results showed statistically significant differences in the position of nursery school teachers regarding the opinions in the introduction of the ICTs in the management $t(126) = 3.496$, $p < 0,05$, with holders of a management position ($M = 1.7903$, $SD = 0.199$) to consider more positive opinions in the introduction of ICTs in the management of nursery schools than teachers with no managerial positions ($M = 1.6610$, $SD = 0.214$).

Relationship between the Opinions of Preschool Teachers for the Utilisation of ICTs in the Management and Preparation of Teaching and the Position They Hold (Administrative or Not)

To investigate the relationship between the positions the teachers hold and their opinion for the utilisation of ICTs in the management and preparation of teaching, the analysis was conducted by using the T - test for independent samples (administrative position, not an administrative position). The results showed statistically significant differences regarding the position of pre-school teachers and the use and the utilisation of ICTs in the management and preparation of teaching $t(113,025) = 5.509$, $p < 0,05$, with holders of management positions ($M = 2.5921$, $SD = 0.463$) utilising ICTs more in the management and preparation of teaching, utilisation of e-mail tools, text editors, management information systems for the logistics of the nursery school and educational software, electronic encyclopaedias, search engines and tools for the preparation of teaching than teachers with no management position ($M = 1.8859$, $SD = 0.867$).

Relationship between the Stances of Preschool Teachers in the Use and Utilisation of ICTs in the Management of Nursery Schools and the Position They Hold (Administrative or Not)

To investigate the relationship between the position and stances of pre-school teachers in the use and utilisation of ICTs in the management of nursery schools the analysis was conducted by using the T - test for independent samples (administrative position, not an administrative position). The results showed statistically significant differences regarding the position and the stances of pre-school teachers in the use and utilisation of the ICTs in the management of nursery schools $t(114,538) = 3,806$, $p < 0,05$, with holders of management positions ($M = 2.5561$, $SD = 0.424$) having a positive attitude towards the use and utilisation of the ICTs in the management of nursery schools, using and utilising e-mail tools, text editors and management information systems for the logistics of the nursery school in comparison to teachers with no managerial positions ($M = 2.1488$, $SD = 0.771$).

Relationship between the Level of the Self-efficacy of Preschool Teachers to the Use and Utilisation of ICTs in the Learning Process and the Position They Hold (Administrative or Not)

To investigate the relationship between the position and the level of the self-efficacy of preschool teachers to the use and utilisation of the ICTs in the learning process the analysis was conducted by using the T - test for independent samples (administrative position, not an administrative position). The results showed no statistically significant differences in the position of preschool teachers and the degree of their self-efficacy to the use and utilisation of ICTs in the learning process, with both having a very high degree of self-efficacy in the use and utilisation of educational software, electronic encyclopaedias, search engines, presentational tools, and tools for the learning process.

Relationship between the Degree of Use and Utilisation of ICTs in the Learning Process by Preschool Teachers and the Position They Hold (Administrative or Not)

To investigate the relationship between the position and the degree of use and utilisation of ICTs in the learning process by preschool teachers the analysis was conducted by using the T - test for independent samples (administrative position, not an administrative position). The results showed statistically significant differences in the position of preschool teachers and the degree of use and utilisation of ICTs in the learning process $t(122,342) = 4.202$, $p < 0,05$, with holders of management position ($M = 2.7668$, $SD = 0.586$) having a higher degree of use and utilisation of ICTs in the learning process, using and utilising educational software's, electronic encyclopaedias, search engines, presentational tools and tools for learning process than teachers with no management position ($M = 2.2110$, $SD = 0.904$).

Conclusions

The basic conclusions of the current research are focusing on the following.

One of the main goals of this research was the investigation between the opinions of pre-school teachers for the introduction of ICTs in the management of the nursery schools and the position (managerial or not) that they hold in the school unit.

The research showed that the teachers that hold a managerial position have a more positive opinion for the introduction of ICTs in the management of the nursery schools. Also, the investigation of the relationship between the opinions of the pre-school teachers for the utilisation of ICTs in the management and the preparation of teaching and the position (managerial or not) the teachers have in the school unit has shown that the teachers that have a managerial position utilise ICTs in the management and preparation of teaching more by using mail tools, text editors, logistics for the managerial support of the nursery school and the educational software, electronic encyclopaedias, search machines and tools for the preparation of teaching.

The investigation of the relationship between the stance of the pre-school teachers in the use and utilisation of ICTs in the management of the nursery schools and the position (managerial or not) that they have in the school unit has shown that the teachers that have a managerial position have more positive stance in the use and utilisation of ICTs in the management of the nursery schools by using and utilising mail tools, text editors, logistics for the managerial support of the nursery school. Regarding the investigation of the relationship between the level of self-efficacy of the pre-school teachers in the use and utilisation of ICTs in the learning process and the position (managerial or not) that the teachers have in the school unit, the research has shown that both groups have a very high level of self-efficacy in the use and utilisation of the education software, electronic encyclopaedias, search engines, presentational tools and tools used for the learning process.

Lastly, the investigation of the degree of the usage and utilisation of ICTs in the learning procedure by pre-school teachers and the position (managerial or not) that they hold in the school unit has shown that the teachers that hold a managerial position also have a higher degree in the usage and utilisation of ICTs in the learning process by using and utilising educational software, electronic encyclopaedias, search engines, presentational tool and tools that help in the learning process.

Discussion of the Results

In the sensitive area of education, where all society's hopes for progress and development are reflected, the qualitative upgrade of the educational system is the desideratum.

The Ministry of Education, by understanding the needs and responding to the requirements of the Lisbon Treaty, organized and ran teachers' trainings in new technologies with the main goal of the trainings being for the trainees to understand the conditions and the abilities of the pedagogical utilisation of ICTs in education for the upgrade in the educational procedure and learning and that the teachers can use the abilities offered by ICTs effectively for their active participation of the educators and the students in learning progress. In addition, the teachers should obtain the total supervision for the current educational software and the current general and specific tools (internet, word editor, excel spreadsheets) so that they can utilise the introduction of ICTs in the educational practice. Furthermore, they have to be in position to use educational software which is specific to their specialty, general or specific tools, to realize the importance and the role of the educational activity for the application of ICTs in the classroom and also to understand the principles of the design of an educational activity so that they can introduce it to the educational practice. Lastly they should be able to recognize the basic principles of organization and management of ICTs in the classroom.

The current research has shown the same as the record of recent surveys, that the pre-school teachers amend their opinions and stances regarding the usage of new technologies in the nursery school by going through the phase of denial and cautiousness to a positive approach. It seems that the nursery school teachers understand the dynamics of technology, understand that their position and their role is not threatened and that under no circumstances the dynamics of their knowledge it's belittled; on the contrary, with the adoption of new mechanisms and processes it is strengthened and stabilized. However, a slight precedence to such development there is for the teachers of pre-school education that hold a managerial position. Lastly, the results of the current research have brought to the surface a very interesting topic which is that of the educational support of the effort of the teachers to utilise ICTs in teaching, by introducing a framework of educational support at the level of the Educational Authority by institutionalising appropriately trained teachers who will induce responsibility in the education leadership of their colleagues and the embedding of ICTs in the educational process.

References

Bandura, A. (1997). *Social learning theory*. Englewood Cliffs, New Jersey: Prentice-Hall Inc.

Christodoulou-Gliaou, N., & Gourgiotou, E. (2009). Attitudes of kindergarten teachers of public and private kindergartens to use the computer in the preschool classroom. *Inspection of Educational Affairs, 125*, 148-165.

Cohen, J. (1991). Quantitative methods in psychology. A power primer. *Psychological Bulletin, 112*(1), 155 – 159. American Psychological Association

Cohen, L., Manion, L., & Morrison, K. (2008). *Research methods in education*. New York: Routledge

Compeau, D., & Higgins, C. (1995). Computer self-efficasy: Development of a measure and initial test. *Management Information System Quarterly*, 189-211.

EAITY (2009), Teacher Training in support of ICT in teaching practice, level B. Retrieved February 2013 from http://b-epipedo2.cti.gr/

Emvalotis, A., Katsis, A., & Sideridis, G. (2006). *Statistical educational research methodology*. Ioannina (in Greek).

Gialamas, B., Zaranis, N., & Tsara, E. (2009). *Opinions of kindergarten for the use of computer in mathematics in kindergarten*. 5th Hellenic Conference of teachers on ICT Utilization of Information Technologies and Communication in Teaching Practice, Syros.

Goti, E., & Ntinas, K. (2010). Kindergarten teachers and computers: A path ten years. *Proceedings of the 3rd National Conference Et.E.A.D. The teacher and his work. Past, present, future*, Vol. B, 875-892

Javeau, C. (2000). *Survey using questionnaires. The manual of the good researcher*. Athens: Tipothito (in Greek).

Jimoyiannis, A. (2008). Factors determining teachers' beliefs and perceptions of ICT in education. In A. Cartelli & M. Palma (Eds.), *Encyclopedia of information communication technology*, pp. 321-334, Hershey, PA: IGI Global

Jimoyiannis, A., & Komis, B. (2006). ICT in education: Exploring the views of teachers of secondary education. *5th Greek Conference with International participation "Information Technologies and Communication in Education*", 829-836, Thessaloniki.

Kartsioti, Th. & Roussos, P. (2010). *Construction psychometric measurement tool of computer use by teachers for teaching*. Retrieved from http://old.psych.uoa.gr/~roussosp//gr/index.htm

Kassotakis, S & Roussos, P. (2006). *The Greek-efficacy scale in computer usage*. Retrieved from http://www.etpe.gr/custom/pdf/etpe1160.pdf

Kolerda, S., Sarafidou, K., & Spyridakis, A. (2013). The need for training of school director in ICT. *Educational Science Magazine "Ekp@ideftikos cycle", 1*(1), 83-185.

Lovari, D., & Charalampous, K. (2006). *Comparison of the results for information and communications technologies using conventional media in teaching and learning processes in a particular subject area of early childhood education*. Technologies in Preschool Education. 9th Conference of Cyprus Pedagogical Association.

Mainas, D. (2009) Teacher training in the use and exploitation of ICT the educational teaching process: An evaluation attempt. Retrieved from www.epyna.eu/agialama/synedrio_syros_5/eisigiseis/706_mainas_c.doc

Ntinas, K. (2010). New technologies and language teaching: An account- emerging perspectives. 3rd National Conference 'Achilles Tzartzani' for the Greek Language, Tirnavos. Accessed from: http://www.larissa.gr/main.aspx?catid=81&year=2010

Oikonomidis, B., & Zaranis, N. (2010) The use of the computer in preschool education: Interviews with nursery school teachers. *Proceedings of the 7th Pan-Hellenic Conference with International participation "The ICT in Education*", Volume II, University of Peloponnese, Corinth, 545– 552.

Papadimitriou, S. (2013). *Views of kindergarten teachers for the implementation of a research evaluation tool infants in computer skills*. thesis, Thessaloniki: Aristotle University

Passa, S. (2010). *The efficacy study of the training program for primary school teachers in using ICT in the educational teaching process (B- Epipedo), through the views of learners and their trainers. The case of the county of Preveza and Arta*. Diploma Thesis, Patra: HOU.

Petrogiannis, K. (2010). The relationship between perceived preparedness for computer use and other psychological constructs among kindergarten teachers with and without computer experience in Greece. *Journal of Information Technology Impact, 10*, 99-110.

Roussos, P., & Tsaousis, Y. (2011). *Statistics for the behavioral sciences using SPSS.* Athens: Topos.

Sim, J. CH., &Theng, L.B. (2007). *Teachers' perceptions of the use of ICT as an instructional tool in mathematics and science*. Retrieved from http://ictl.intimal.edu.my/ictl2007/proceeding/Full_Paper/1A-03-Paper%2069%20(Malaysia).pdf

Trapsioti, A. (2010). *One year after the training: Teachers utilize new knowledge and skills in the classroom*. Retrieved from http://mag.e-diktyo.eu/?cat=51

Vasileiou, E., & Mikropoulos, T. (2005). Learning activities with a computer in kindergarten. *3rd Greek Conference of Teachers for ICT* (596-604, volume B). Athens: New Technologies.

Zafeiropoulos, K. (2005). *How we create a scientific paper? Scientific research and essay writing*. Athens: KRITIKI (in Greek).

Zetta, B. Papaconstantinou, S. & Apostolidis, G. (2009) Evaluating the B-level training for the use of ICT in educational process to philologists of Serres, Drama and Kavala. Retrieved from http://www.etpe.eu/new/custom/pdf/etpe1451.pdf

Appendix

QUESTIONNAIRE

School area

Urban ☐
Suburban ☐
Rural ☐

A. DEMOGRAPHICS

1. Gender: Male ☐ Female ☐
2. Age: ___________
3. Years in total in education service: ______________
4. Position you hold in kindergarten are working:

☐ Administrative position (Head / Director)
☐ Non-management position (Teacher)

5. Qualifications / Knowledge Level:

☐ Bachelors Degree
☐ Second Bachelors Degree
☐ Master Title
☐ Doctoral Title

B. INTRODUCTION OF ICT IN ADMINISTRATION OF KINDERGARTENS

1. Do you have computer knowledge?
   ☐ YES
   ☐ NO

2. If you have knowledge of computer, note:
   a. Participation in training seminars
   b. self-education

3. Do you use a computer in the classroom?
   ☐ YES
   ☐ NO

4. For which activity are you using ICT to conduct administrative work in your nursery? (Note which of these apply).

a.	Email	
b.	Typing - Printing documents	
c.	Update on interactive portal (my school)	
d.	Computerization of School	
e.	Electronic Protocol	

5. Have you received some kind of training in new technologies?

- YES
- NO

6. Note the operator who conducted your training in new technologies.

University / Technological Institute	
Ministry of Education	
Municipality (City / Region)	
School Director / Teachers' Association	

7. Do you agree that education in information and communication technologies should be continuous?

- YES
- NO

8. Which of the following reasons do you think that make education in information and communication technologies continued?

a. Greater familiarity with computer
b. The constant evolution of technology
c. Utilization of Computer in Teaching
d. Strengthening of professional qualifications

9. How necessary is training in the use of new technologies?

Very Much	Usually	Sometimes	Seldom	No, never

10. How necessary is training in the use of new technologies in connection with your teaching subject?

Very Much	Usually	Sometimes	Seldom	No, never

11. What extent do you think that training met your training needs?

Very Much	Usually	Sometimes	Seldom	No, never

12. Did you make use and to what extent the knowledge acquired from the trainings in everyday practice in kindergarten?

Very Much	Usually	Sometimes	Seldom	No, never

13. How often do you think that training in ICT should be done?

Annual	Every two years	Every four years

14. What time period do you consider that a training program for the use of ICT in the learning process should have?

Short duration (up to 60 hours)	Average length (120- 180 hours)	Long (300-500 hours)

15. Which form do you wish to have for your service training?

a.	Educational workshops	
b.	Intensive Seminars	
c.	Long training programs	

16. If you have not received a training on the ICT, which of the following is the main reason?

a.	Training didn't gave importance to the specific issue	
b.	Failure to follow training (lack of time, transition difficulties, family responsibilities)	
c.	Monitoring training programs is a "waste of time"	
d.	The "ICT" does not concern me as a matter of training	

C. USE OF ICT IN ADMINISTRATION OF KINDERGARTENS

1. How often do you use the computer to the kindergarten for administrative actions?

Very Much	Usually	Sometimes	Seldom	No, never

2. Do you agree that information and communication technologies should be used in the administration of the kindergarten ?

□ YES
□ NO

3. What extent do you agree that the use of computer management is necessary:

Very Much	Usually	Sometimes	Seldom	No, never

4. How often do you use new technologies in kindergarten for each of the following cases of administrative actions?

	Very Much	Usually	Sometimes	Seldom	No, never
File management					
Contact (e-mail)					
Typing - printing documents					
Update on interactive portal (my school)					
Computerization of school					
Electronic Protocol					

5. Are you reviewing the introduction of the ICT in the administration of kindergarten ?

Very Much	Usually	Sometimes	Seldom	No, never

D. INVESTIGATION OF STAGING OF PARTICIPANTS IN THE ADMINISTRATIVE PROCEDURE KINDERGARTENS

1. To what extent do you consider that the use of ICT contributes to the efficient running of the administrative work in your nursery?

Very Much	Usually	Sometimes	Seldom	No, never

2. For which of the following reasons do you believe that it is necessary to use ICT in the efficient running of the administrative work in your nursery?

a.	Time Saving	
b.	Ability to better Organization	
c.	Cost Reduction	

3. What extent do you consider that you are satisfied from your existing technical equipment regarding the use of ICT in the efficient running of the administrative work in your nursery?

Very Much	Usually	Sometimes	Seldom	No, never

4. In which of the following areas / activities related to the administrative work in your nursery, the use of ICT contributes more?

		Very Much	Usually	Sometimes	Seldom	No, never
a.	The stream-lining of administrative functions					
b.	The easier and more friendly to the user management of standardized management procedures					
c.	The faster and easier communication between schools					
d.	The transparency of administrative actions					

E. LOOKING INTO THE SELF-EFFICACY OF TEACHERS IN THE USE AND EXPLOITATION OF ICT IN THE LEARNING PROCESS.

In the table below please circle one of the numbers 1-5, where 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.

I feel that I can:

Organize files stored on the computer in folders	1 2 3 4 5
Write a text on the computer	1 2 3 4 5
Handle objects (such as buttons, icons, windows, scroll bars, menus, drop-down lists, etc.) with ease	1 2 3 4 5
Make changes to print a file in terms of printing quality, the number of pages, number of copies, print specific pages etc.	1 2 3 4 5
Face simple problems (for example, to connect a device that has been disconnected, install a printer, etc.) on the computer	1 2 3 4 5
Format a text document (eg, to change the size, font color, paragraph formatting, etc.) in the P/C	1 2 3 4 5
Download and read the attachments containing an email	1 2 3 4 5
Forward to other recipients an email message that I received	1 2 3 4 5

Search for information on a topic on the Internet (Internet) using search engines	1 2 3 4 5
Download a file from the Internet (Internet)	1 2 3 4 5

F. LOOKING INTO THE DEGREE OF USE AND DEVELOPMENT OF ICT IN LEARNING PROCESS OF A KINDERGARTEN

1. How often do you use the computer in the learning process?

Very Much	Usually	Sometimes	Seldom	No, never

2. Do you agree that information and communication technologies should be used in kindergarten?

 YES
 NO

3. What extent do you agree that it is necessary the use of the computer in your teaching?

Very Much	Usually	Sometimes	Seldom	No, never

4. If you agree to the use of ICT in Kindergarten, note the extent to which you agree that new technologies can be used in each of the following cases:

	Very Much	Usually	Sometimes	Seldom	No, never
File management					
Contact (e-mail)					
In teaching (general)					
Update of the teacher					

5. If you disagree with the use of ICT in Kindergarten, note the reason why this is the case for you:

I do not consider their use necessary	
There are not given instructions on the use of ICT in the curriculum	
Requiring additional time for their use	
I feel insecure in relation to the use of ICT in Kindergarten	

6. Methods and frequency of use of the computer from the educator for the preparation of teaching:

	Very Much	Usually	Sometimes	Seldom	No, never
In the Internet to find information and teaching material (Visiting blogs, wikis)					
Educational software of the Pedagogical Institute					
Electronic libraries for finding information					
Text processors (Word) for course notes					
Spreadsheets (Excel) for activities					
PowerPoint for presentations					
Multimedia, video, photos,					
Online collaborative tools (example: Wikipedia)					
Graphics, audiovisual material (eg video, DVD, Youtube)					

7. Methods and frequency of computer use by the teacher for teaching:

	Very Much	Usually	Sometimes	Seldom	No, never
For finding information on the Internet (Visiting blogs, wikis)					
For teaching subjects (Language, Mathematics, B. Sciences, etc.) with appropriate internet educational software					
For teaching subjects (Language, Mathematics, B. Sciences, etc.) with original educational software that the teacher prepares					

For training programs drawn up during the year (environmental, health education, culture, etc.) using the appropriate generic software (Word, Excel, PowerPoint)					
For training programs drawn up during the year (environmental, health education, culture, etc.) with original educational software that the teacher prepares					
For activities with children's activities (e.g., by presenting scanned paintings of children)					
For educational activities with software that the children bring in storage media (cd-rom, dvd, flash memory, etc.)					
Recreation (games, painting, music, etc.)					
To use graphics and audiovisual material (eg video, DVD and YouTube)					
For using email					

8. For which learning areas of the new curriculum for the kindergarten and how often do you use the computer?

	Very Much	Usually	Sometimes	Seldom	No, never
For language courses					
For math class					
For the course of Environmental Education					
For the course of Aesthetic Education					
For the Health Education course					

9. Would you assess positively the use of ICT in the learning process of kindergartens?

Very Much	Usually	Sometimes	Seldom	No, never

Biographies

Stefanos K. Goumas was born in Athens, Greece, in 1960. He received the B.Sc. degree in mathematics from the National and Kapodistrian University of Athens, in 1984 and the B.Sc. degree in computer science from the University of Crete, Greece, in 1994. Also he received the M.Sc. and Ph.D. degrees from the Technical University of Crete, Greece, in 1999 and 2008, respectively, all in electronic and computer engineering. After holding a visiting Assistant Professor position with the Technological Educational Institute of Crete, from 1991 to 2003, he joined the Technological Educational Institute of Eastern Macedonian and Trace in 2003 where he is currently an Assistant Professor with the Business Administration Department. Dr. Goumas has been participant investigator in 8 research projects, funded both publicly and privately, in the European Union. He has authored or co-authored over 30 publications in scientific journals and referred conference proceedings. His research interests include automated inspection systems, signal and image processing and analysis, wavelet analysis for data/image processing and compression, neural networks, fuzzy logic and genetic algorithms in pattern recognition applications, multimedia databases, geographical information systems and educational technology. Dr. Goumas is a member of the Greek Computer Society.

Symeon A. Symeonidis was born in Kavala, Greece, in 1976. He received the B.Sc. degree in Automation engineering from the Technological Educational Institute of Piraeus, Greece, in 2000. Also, he received the M.Sc. Work Based Learning Studies Information Technology degree from Middlesex University, UK, in 2007 and M.Ed. Adult Education degree from Hellenic Open University, Greece, in 2014. He worked as a visiting Lecturer position in Technological Educational Institute of Eastern Macedonian and Trace, from 2002 to 2014. Now, he works as IT teacher in Secondary Education of Kavala. He has authored or co-authored over 10 publications in scientific journals and referred conference proceedings. His research interests include automatic control systems, signal and image processing and analysis, neural networks, fuzzy logic, Databases, multimedia databases, programming, educational technology and Adult education.

Michael D. Salonidis was born in Drama, Greece, in 1968. He received the B.Sc. degree at the Pedagogical Academy of Larissa in 1989. In 1999 he graduated from the Pedagogical Department of Alexandrou-polis. He received the M.Sc. from Technological Educational Institute of Eastern Macedonian and Trace in 2015, in Management Science and Information Systems. Since 1996 he is teaching at primary schools. He has authored or co-authored 5 publications in scientific journals and referred conference proceedings. His research interests include Educational Multimedia, Educational Technology, Educational Robotics and E-Learning Services.

This page left blank intentionally

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Moncada Linares, S., & Díaz Romero, C. (2016). Developing multidimensional checklist for evaluating language-learning websites coherent with the communicative approach: A path for the knowing-how-to-do enhancement. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 57-93. Retrieved from http://www.ijello.org/Volume12/IJELLv12p057-093Moncada2161.pdf

Developing a Multidimensional Checklist for Evaluating Language-Learning Websites Coherent with the Communicative Approach: A Path for the Knowing-How-To-Do Enhancement

Sthephanny Moncada Linares and Andrea Carolina Díaz Romero
Universidad La Gran Colombia, Colegio Cristo Rey, Bogotá, Colombia

sthephanny.moncada@ugc.edu.co; carolinaromero20141@outlook.com

[NOTE: A shorter version of this paper was presented at the Eighth edition of the International Conference ICT for Language Learning (Florence, Italy, 2015).]

Abstract

As a result of the rapid development of Information and Communication Technology (ICT) and the growing interest in Internet-based tools for language classroom, it has become a pressing need for educators to locate, evaluate and select the most appropriate language-learning digital resources that foster more communicative and meaningful learning processes. Hence, this paper describes a mixed research project that, on the first hand, aimed at proposing a Checklist for evaluating language websites built on the principles of the Communicative Approach, and on the second hand, sought to strengthen the teachers' Knowing-how-to-do skill as part of their digital competence. To achieve these goals, a four-phase research procedure was followed that included reviewing relevant literature and administering qualitative and quantitative research methods to participants (i.e., language teachers, an expert in the Computer-Assisted Language Learning (CALL) field and a college professor) in order to gain insights into problematic issues and, thereafter, to contribute to the creation and validation of the Checklist model and the Study Guide. The findings revealed that: (a) evaluating language websites leads to the enhancement of the teachers' practical skills and their knowledge of the technological language; and (b) having an assessment instrument allows educators to choose the materials that best meet their communicative teaching purposes.

Keywords: Language-learning website, communicative approach, CALL evaluation, checklist, digital competence, knowing-how-to-do skill

Introduction

The great influence of the Internet on all areas of society (e.g., politics, economy, leisure, relationships, education) has managed to redefine and extend the boundaries of interpersonal communication, entertainment, information transfer, teaching practices, and so forth. There-

Editor: Gila Kurtz
Submitted: November 22, 2015; Revised: February 16, 2016; Accepted: February 20, 2016

by, in the education realm, especially in the language teaching and learning context, the integration of the Internet as a supporting pedagogical means has brought new and innovating opportunities for students to encounter an endless number of authentic and motivating materials, to engage with subject content, to interact in real-time and exchange meanings with people from other cultures, and to become autonomous, intercultural and collaborative learners (Warschauer, Shetzer, & Meloni, 2000). These positive effects have been highly appreciated by language teachers seeking to approach pupils in a more innovative and meaningful learning environment beyond the traditional four-wall classroom, where free-access online resources such as language websites have become an increasingly appealing option to achieve this goal.

However, it should also be noted that when resorting to websites for enhancing language learning outcomes, teachers must be aware of its limitations in regards to its internal architecture and its implications on a certain language teaching approach. Thus, in the first place, its possibilities of engaging users in real communicative exchanges appear to be slightly minor, unlike e-learning spaces (e.g., Blackboard, WebCT) that are capable of simultaneously providing a multiplicity of management, communication and interaction features. Therefore, websites may exhibit some difficulties in terms of: (a) integrating asynchronous and synchronous communication tools that facilitate spontaneous language production; (b) centering more on discourse, contexts and culture rather than solely focusing on forms; and (c) giving less limited feedback that surpasses the automatic treatment of errors (Cruz, 2003; E. Fernández, 2007; García, 2000; Kartal, 2005; Lozano & Ruiz Campillo, 2009; Magnúsdóttir, 2010; Torat, 2000).

Consequently, the majority of websites tend to present language grounded on a behaviorist approach, by promoting deductive grammar explanations as well as structuralist and audio-lingual exercises (e.g., multiple-choice and close-ended questions, true or false items, and fill in the blank, drills) that do not account for the authentic use of the target language. This has been mainly facilitated by the ease, attractiveness and immediate feedback delivery that authoring programs such as Hot-Potatoes and WebPractest commonly offered to create language content (Cruz, 2002; Kartal, 2005; Magnúsdóttir, 2010), which in turn has led to a significant increase and never-ending supply of free-access websites that do not necessarily guarantee its overall quality and pedagogical potential.

Hence, and unlike what everyone might think, web-based teaching undeniably constitutes a difficult and demanding task for educators, as they might probably do not know to what extent websites support an effective communicative language learning process and which sites to choose from the wide array of possibilities offered by the Internet (Hassan & Fakulti, 2011; Son, 2005; Susser, 2001; Yang & Chan, 2008). This is the reason why teachers need to be discerning and thoughtful when deciding on the most reliable, practical and valid online resources, which should be ideally built on the principles of a teaching approach that encourages free and creative expression of the target language in realistic communicative contexts.

In this sense, as 21st century citizens, educators are being asked to acquire the Knowing-how-to-do skill as part of their Digital Competence (European Parliament and European Council, 2007) to be able to evaluate the instructional purposes and language teaching objectives of any online resource just before taking it to the class (Hubbard, 2006; Nomdedeu, n.d.). Thus, the need arises for a website evaluation model (Checklist) that initially guides them to efficiently find and judge the overall appropriateness of any language site in terms of its technical and pedagogical (i.e., learning potential driven by the Communicative Approach) properties and capacities, so that they gradually gain expertise in this field while growing in their Knowing-how-to-do skill, as it is the case of the target population that participated in this study.

Therefore, with the purpose of addressing this issue, the present paper follows this general structure: first, it situates the reader in the literature review section that encompasses topics such as website, the Communicative Approach, CALL evaluation and Digital Competence, and then it displays the four-phase methodology used to conduct this research along with the findings, discussion and conclusion sections.

Approaches to Language-Learning Website Evaluation

The increasing implementation of websites to supplement language learning instruction has driven teachers and researchers to undertake the task of evaluating its value, effectiveness and quality. The growing literature in this field has provided multiple checklists models that encompass a global set of features related to the interface and aesthetics of the site, its functionality, usability, efficiency, navigation, reliability, authority, unity and some other technical elements that facilitate users' experience when surfing online and which should be reflected in general types of sites. Additionally, a few of these checklist proposals integrate a pedagogical dimension, but mostly focus on measuring linguistic variables that include controlled practice exercises of receptive language skills, grammar explanations, vocabulary lists, drilling, as well as aspects comprising instruction delivery, learning objectives, target audience and the difficulty level of exercises. Table 1 shows a brief description of some of these models.

It is important to indicate that evaluating a language website is not just a matter of judging its general layout and the elements that solely enhance learners' linguistic competence; it should also attempt to look for those features that promote a more authentic and creative use of the target language. Thus, autonomy, language contextualization, integration of the four language skills, interculturality, interaction and evaluation (Cruz, 2002; Hita, 2004; Higueras, 2010; Luzón & Soria, 1999; Richards & Rodgers, 1986) become principles capable of promoting within website communicative language-learning processes directly dependent on the level of capacities and functionalities these kinds of online resources possess. Moreover, these evaluation models focus specifically on the sites' intrinsic properties but are not concerned with, for example, what learners will be able to do, in terms of language learning cognitive processes, when surfing its contents.

Table 1: Existing evaluation criteria for websites and online materials

Author(s)	Evaluation Criteria
Stoker & Cooke (1994)	**1.** Authority **2.** Genealogy or origin of the source **3.** Scope and treatment (purpose, coverage, currency and methods of revision, accuracy, objectivity, audience) **4.** Format **5.** Arrangement **6.** Technical considerations **7.** Price and availability **8.** User support
Marquès (1999)	**1.** Functionality and usability **2.** Technical and aesthetic features **3.** Pedagogical and psychological features (motivation capacity to be attractive and interesting, adaptation to users' characteristics and needs, didactic resources potentiality, self-learning and initiative encouragement)
Lázaro & Fernández (2000)	**1.** Identification of the material (recipients of the information, level of activities, learning objectives in relation to the content, timing, index and required skills) **2.** Authorship **3.** Navigation **4.** Interface **5.** Functionality and usability

Author(s)	Evaluation Criteria
Son (2005)	**1.** Purpose **2.** Accuracy **3.** Currency **4.** Authority **5.** Loading speed **6.** Usefulness (convenient information and language activities) **7.** Organization **8.** Navigation **9.** Reliability **10.** Authenticity (language learning authentic materials) **11.** Interactivity **12.** Feedback **13.** Multimedia **14.** Communication (Bidirectional communication among learners) **15.** Integration of the online material into the curriculum
Aly (2008)	**1.** Authority **2.** Purpose **3.** Coverage **4.** Currency **5.** Objectivity **6.** Accuracy **7.** Technical aspects **8.** Usefulness for EFL Teachers and Students (usefulness and helpfulness in developing learners' four language skills, grammar, vocabulary and pronunciation)
Higueras (2010)	**1.** Technical aspects **2.** Reaping the benefits given by the online environment **3.** Profitability of internet access **4.** Reliability **5.** Amount of information provided for the teacher and student
Kartal & Uzun (2010)	**1.** Physical characteristics **2.** Contextual characteristics (features of the site content such as testing tools, software, lesson plans, exercises) **3.** Pedagogical characteristics (features that contribute to the learning and teaching process)
Liu, G., Liu, Z., & Hwang, (2011)	**1.** Web usability **2.** Learning materials **3.** Functionality of assisting language learning (offers multi-channel and hyperme promoting language learning), **4.** Technology integration (inclusion of technological resources to enhance the websi its users)

Therefore, the present study contributes to the literature of language website evaluation by providing a multidimensional checklist based upon the theoretical framework of the Communicative Approach, which, additionally, seeks to augment the teachers' sense of self-confidence and critical thinking when selecting the language sites that best match their language teaching purposes.

Theoretical Framework

This research study was guided by a review of relevant scholarly literature on the topics of Website, Communicative Approach in virtual environments, CALL evaluation and Digital Competence. The contributions given by the authors provided background information to support the construction of the Checklist model and the Study Guide derived from this project.

Website

The large supply of available free-access online resources has become, in recent years, an increasing trend in language education. Specifically, *Websites,* as innovative digital settings and as part of new technology, have been highly recommended and used to supplement and enhance language learning. Authors such as E. Fernández (2007) have defined these resources as a collection of webpages interrelated to each other by hyperlinks hosted in a same URL (Uniform Resource Locator) that are created for specific purposes (García, 2000; Higueras, 2010; Marquès, 1999; Nomdedeu, n.d.); in this case, for promoting language learning practices by including several activities, exercises, links and extra tools (Mangenot, 1998). In relation to this, it is important to clarify that Websites or Sites are not the equivalent of Webpages (Codina, 2000; Higueras, 2010) since, unlike what people might commonly think, these latter consist of a single page information or document contained within a website, characterized for being written in a HTML (HyperText Markup Language) format (E. Fernández, 2007) that enables hypertextuality and hypermedia (Rodríguez, 2004) to take place.

Thus, the technological potential of Websites and what make them suitable supporting instructional materials come from its internal architecture design that encompasses useful features such as Hypertext, Multimedia, Hypermedia and Interactivity (Area, 2009). First of all, *Hypertext* refers to a non-linear system of interconnected documents that allow users to decide on the pathways to follow through the site. *Multimedia* integrates several forms of information content such as text, audio, graphics and animations. On the other hand, *Hypermedia* is related to the combination of hypertext and multimedia used for instruction, entertainment and information management. And finally*, Interactivity* comprises the possibility for users to receive any kind of automatic feedback as a response of a given action.

Apart from these elements, if the aim is to maximize the user's experience when surfing a quality site, it should also provide: (a) an easy accessible and intuitive interface design that encompasses attractive and motivating colors, illustrative, explanatory or decorative images, icons as well as frames that enable the site to be divided into independent areas; (b) an efficient and understandable navigation system design (i.e., dropdown menus, toolbars, sidebars, etc.); and (c) a tree design structure that hierarchically indicates the site's content in order to simplify the browsing paths (Calero, cited by García, 2000). These attributes directly affect users' disposition towards learning a target language as they make websites more user-friendly, appealing and reliable environments, just as has been considered by authors such as Aly (2008), Higueras (2010), Kartal and Uzun (2010), Lázaro and Fernández (2000), Marquès (1999), and Stoker and Cooke (1994), who were presented in the previous section.

Finally, it is worth noting that websites can be classified in relation to its general structure, hyperlink patterns and the editors' purposes (Area, 2009; Gonzalo, 2006; E. Fernández, 2007; Marquès, 1999; Nomdedeu, n.d.). In this sense, when browsing the net, users might encounter: *search engines* created to crawl, index and search for online information; *web directories* of categorized webpages interconnected by hyperlinks; *corporate sites* of commercial nature with a limited number of links to other sites; *hosting services* where several websites are housed (Gonzalo, 2006); *personal sites* designed to display the editor's curriculum; and finally, *sites for education*, specifically created to facilitate learning and provide didactic resources (Marquès, 1999). This latter, within the language teaching context, consists primary of a series of linguistic exercises that take advantage of hypertextuality, multimedia and interactivity elements to promote language practice (Cruz, 2004), also known as "self-access CALL materials" (Mishan, 2013) intended for independent study and as a complement to classwork (Chuo & Kung, 2002).

The Communicative Approach in Virtual Environments

In the present research study, the Communicative Approach will be considered as the theory of language learning that advocates for the development of the communicative competence by which students are able to use the target language appropriately and effectively in real communication contexts. To accomplish this goal, authors such as Canale and Swain (1980), Chamorro (2009), Higueras (2010), Hita (2004), Luzón and Soria (1999), Melero (2004), Richards and Rodgers (1986), have pointed out that language education should meet fundamental communicative principles such as: (a) place students at the center of the process to allow them greater autonomy; (b) encourage exchange and negotiation of meanings; (c) foster interaction and the integration of the four language skills; (d) make emphasis on learning and its formative assessment; and (e) always contextualize the language.

In this regard, and with the growing interest in technology potentials, online resources have been considered instructional materials par excellence to meet the above principles (Adell, 1995; Cruz 2002; Higueras, 2010). Thus, for example, language websites are capable of promoting to a greater or lesser extent the communicative and meaningful use of the target language by integrating the following properties.

On the first hand, there is the *Hypertextuality* that allows language learners to manage the site's content and choose the order of discourse; an action that activates their rational thinking by favoring the interconnection between prior and present knowledge and, consequently, arousing their capacity for reflection, analysis and interpretation (Cruz, 2002). One of its greatest advantages is that it gives students the choice to take different pathways in relation to their interests, communicative needs, learning styles and pace as well as their language level, a feature that promotes an active and more *autonomous* role rather than a passive stance (Higueras, 2010; Mao & Kung, 2001).

Besides, hypertext websites enables users to gradually approach and explore new cultures where the linguistic component is embedded into the cultural one and vice versa (García, 2000), so that by practicing the target language they are able to conduct intercultural exchanges and understanding (Luzón & Soria, 1999).

Then, there is the *Multimedia* that favors knowledge contextualization (Cruz, 2002; Higueras, 2010; Luzón & Soria, 1999), enables practice on receptive language skills (Caridad, 2008), potentiates understanding by simultaneously activating perception senses, and boosts motivation to learning (Mao & Kung, 2001). Moreover, it not only encourages unidirectional communication (i.e., user-machine) but also interaction among users and provides a vast amount of authentic (Cruz, 2002) or pseudo-authentic materials that enhance the website's attractiveness and the students' engagement.

For its part, the *Hypermedia* promotes learning-by-doing in which students are given the possibility to interact with different multimodal presentations (e.g., text, audio, animation, videos, etc.) as it immerses them in a living and dynamic context where language is embedded in culture, so that they can learn within an enriched environment of diverse communicative situations (Cruz, 2002; Liu, 1994). Additionally, it involves learners in an active role whereby through linking and manipulating images, text and videos they become creative users and strengthen their language skills while being motivated to solve specific tasks.

There is also the *Interactivity,* commonly understood in terms of unidirectionality, by which the communicative exchange between user and machine places the student in the role of a transmitter and receiver (Haack, cited by Caridad, 2008; Màrques, cited by Higueras, 2010; Mantilla, n.d.), constituting a basic level of interaction. However, owing to the internal design limitations of most websites, bidirectionality (i.e., user-user), and thus authentic communication, cannot be easily achieved, being the reason why it is advisable that sites link users to external resources or at least, propose a series of activities to be conducted in a face-to-face classroom setting.

In addition to the above, interactivity has been as well defined in relation to the *feedback* provided by websites as a response to learners' input after solving any language exercise or activity. Commonly, language sites offer an automatic close-ended feedback that confirms whether an answer is right or wrong by matching it with predetermined patterns (Caridad, 2008) or giving short explanations. This is what make sites good at strengthening receptive skills through the integration of controlled practice exercises but unable to provide a more flexible feedback system that comprises productive language skills as, unlike e-Learning environments, they would require having an online tutor to guide the learning process (S. Fernández, 1988). Furthermore, despite the feedback immediacy and its possibility of stimulating students' self-correction (Lobin & Rösler, 2012), the errors treatment is still very limited and does not account for learners' ability to communicate in the target language.

Finally, there are the *CMC* (Computer-Mediated Communication) *tools* that represent essential resources to foster effective exchange of meanings and language practice, as they encompass synchronous and asynchronous communication. Thus, the former enables real-time interpersonal communicative exchanges and collaboration among users, encouraged by the implementation of chats, audio-conferencing, instant messaging, among other services that contribute to enhancing learning motivation, the integration of the four language skills and the promotion of collaborative learning and group work (Cruz, 2002; García, 2000). On the other hand, the latter allows the transmission and interchange of information over a period of time via e-mail, listservs, discussion boards, and so forth. These tools encourage students to focus on revising the formal aspects of their messages (i.e., grammatical correctness), the discourse order, the needed vocabulary and the sociolinguistic competence (Rodríguez, 2004), with the aim of gaining self-awareness on the accuracy of the language.

It is worth noting that both these types of online communication tools, especially the synchronous one, are particularly favored in an e-Learning environment (Luzón & Soria, 1999) due to its intrinsic architecture supported by learning management systems and a wide range of applications, which, unlike language websites, do promote to a higher extent personal telematic communications and thus authentic contexts to perform communicative activities.

CALL Evaluation

With the advent of the Internet and its implications in the language teaching and learning context, educators are compelled to possess knowledge and expertise in the CALL field. It involves acquiring practical skills to implement several online materials (e.g., websites) as well as the ability to take a critical and reflective stance for evaluating them in the light of their privileged language teaching approach. This is why, during the past years, researchers and teachers have provided several evaluation proposals in the form of methodological frameworks (Chapelle, 2001; Hubbard, 1996; Plass, 1998), surveys (Hubbard, 2003; Knowles, 1992; Robb & Susser 2000), c*hecklists* (Chapelle, 2001; Cruz, 2002; Higueras, 2010; Hubbard, 2006; Lázaro & Fernández, 2000; Marquès, 1999; Son, 2005; etc.) and some other assessing methods to alleviate the language teachers' complex and time-consuming labor of judging the learning potential of any virtual environment.

In this sense, CALL evaluation has focused on conducting a systematic process to establish the quality, efficiency, overall value and suitability of a given technological material (e.g., software, online course, website, etc.) in order to make a decision on its possible integration into a particular language learning setting (Chapelle, 2001; Hubbard, 2006; Levy & Stockwell, 2006; Robb &

Susser, 2000). This in turn has also implied building evaluation models following three specific aspects that should go hand-in-hand: an approach, a purpose and a method (Duignan, 2003).

To embark on this task, the first step is to think of an *approach,* which refers to a "way of looking at or contextualizing evaluation" (Duignan, 2003, para.1). This can be done by centering on implicit or explicit theoretical assumptions or a set of values that judge the level of congruency between the material's intrinsic properties and its capacity to support learning from a specific language notion (e.g., Communicative Approach) (Hubbbard, 2006).

Then, it is important to determine the *purpose,* which aims at "identifying what evaluation activity is going to be used for" (Duignan, 2003, para.1). It entails deciding on two different modalities of CALL evaluation: the formative and the summative one. The former takes place during the development of a new material and seeks to identify its strengths and possible drawbacks in order to improve it before being approved for use, whilst the latter is done after the completion of the material and aims at determining whether it works well or not for the intended purpose; that is, to boost language learning (Chapelle, 2001, Colpaert, 2004; Levy & Stockwell, 2006; Ma, 2008).

In addition to the above, it is worth noting that the summative evaluation type comprises three levels of analysis: two judgmental-based and one empirical (Chapelle, 2001). On the first level, the CALL material, is decontextualized as the teacher has not used it within a language class and he/she is in the initial process of choosing the most appropriate one from a wide range of possibilities (also conceived by Squires & McDougall (1996) as predictive or selection evaluation and by Reeder et al. (2004) as introspective). Meanwhile, the second level implies the way in which the teacher plans the material's application for a specific context. And the third one reflects on the user's learning outcomes from the material.

Finally, there is the need to think of an *evaluation method* or instrument (e.g., consultations, participant observations, interviews, key informant surveys and questionnaires, checklists, etc.) that leads to the collection, disclosure and subsequent analysis of data from the evaluated object (e.g,. learning material) (Duignan, 2003, para.1). Thus, for example, within the CALL evaluation field, the checklist has been considered as one of the most common and practical instruments highly used by language teachers and researchers to gain "insights on how well a particular program, Web site, or online course is working" (Levy & Stockwell, 2006, p. 45), especially when conducting a first level judgmental evaluation (Chapelle, 2001; Reeder et al., 2004).

This assessment tool is frequently built on a set of evaluation criteria and descriptors presented in the form of questions, categories, features, statements or explanations that aim at issuing a quantitative or qualitative measure over a specific level of accomplishments met by the evaluated object (Levy & Stockwell, 2006; Rodríguez, 2012; Vela, n.d.). In this sense, evaluation descriptors under each criterion are advised to be formulated based on three different elements: *action*, *content* and *condition* (Campoverde, 2006), which, despite being used for judging students' performances, may also account for the CALL materials intrinsic properties to foster quality language learning processes (Díaz & Moncada, 2014).

Therefore, the *action* part of descriptors denotes an achievement expressed in an active verb (i.e., third-person singular) that responds to the question "what language learners will be able to do as a consequence of the CALL material's features?" Verbs can be written following the revised Bloom's taxonomy by Anderson and Krathwohl (2001), who shifted the thinking skills from nouns to verbs, repositioned them and listed them in the form of cognitive processes (Low Order Thinking Skills – LOTS – to Higher Order Thinking Skills – HOTS). Thus, for example, the verb "remembering" implies an information retrieval cognitive activity that can be easily promoted by language-learning materials such as websites.

Additionally, the evaluation descriptor is composed by the *content* to which the action is related to, as well as the *condition* under which this action is expected to be performed (i.e., resources, facilities, tools, etc.). Table 2 exemplifies how these elements join together to become possible evaluation descriptors within a checklist.

Table 2: Examples of evaluation descriptors (HOTS/LOTS)

Cognitive process	**CALL material (e.g., website) allows learners to:**		
	Action	***Content***	***Condition***
Creating	*Generate*	attitudes of openness and empathy towards the target culture	by including texts, readings and/or videos that address issues such as immigration, political debates, human rights, among others
Evaluating	*Check*	their oral comprehension	by clicking on the transcription button for video or audio
Analyzing	*Compare*	cultural traits of various speaking regions of the target language	by integrating topics of cultural interest that have influenced people's lives (e.g., popular culture, politics, history, etc.)
Applying	*Carry out*	oral and written activities that imply a communicative purpose	by offering rich input (e.g., journals, videos, recordings, etc.) and encouraging input elaboration
Understanding	Inductively *Infer*	the uses of certain grammatical forms	by providing input enhancement (e.g., capital letter, boldface, underlining, italics, etc.)
Remembering	*Identify*	in a particular exercise or activity their right answers and correct the errors	by clicking on the auto-feedback button.

It is worth noting that when exploring any learning material, language learners can be stimulated to activate cognitive skills of different levels depending on the provided input and the intrinsic capabilities of the material.

Digital Competence

In this emerging knowledge society, *Digital Competence* has been regarded as one of the eight lifelong learning competences every person must possess in order to effectively use and take advantages of the digital tools at hand (European Parliament and European Council, 2007). It has been even considered as a transversal area that enables people to acquire the other seven fundamental competences, which are communication in the mother tongue, communication in foreign languages, mathematical and basic competence in science and technology, learning-to-learn, social and civic competence, sense of initiative and entrepreneurship, and cultural awareness and expression (Ferrari, 2013).

Within the educational field, particularly in the language-teaching context, Digital Competence has been gaining a lot of attention due to the increasing learning opportunities associated with the rapid development of new technologies and its innovative uses. Consequently, language teachers, as "21st century citizens of the world," have been expected to be more than competent to know why and how to implement technology into their classrooms, to evaluate its appropriateness and suitability for their intended teaching objectives as well as to conscientize students about its educational potential (Fotos & Brown, 2004; Instituto Cervantes, 2012). This has implied mastering and applying basic technology-related ICT instrumental and cognitive abilities resulting from the educators' own Knowledge, Attitudes and *Skills,* three constituent learning domains of any competence (Lara, 2012).

Thus, the first domain involves the understanding of the digital and technical language, the means by which it is materialized as well as its role and the opportunities it provides for users (Knowing). The second one entails an active participation and responsible citizenship to be functional in a digital environment, where values, aspirations and priorities are key elements to act and interact appropriately (Knowing how to be). And the last one refers to a practical knowledge by which individuals posit a critical and reflective mindset when searching, analyzing and selecting suitable digital tools or materials (e.g., websites) and their ability to use them to perform specific tasks (*Knowing-how-to-do skill*).

This latter domain suggests that language teachers become third reviewers or "third-party evaluators" (Levy & Stockwell, 2006, p. 46), responsible for judging the overall quality and appropriateness of a given online learning material based on their specific teaching approach, the learning context, the curriculum and their students' needs. Nonetheless, this is not an ability that can be gained overnight; it requires having background knowledge and expertise in CALL evaluation (Tecnologías Educativas, cited by Lion, 2012), what initially implies making use of helpful assessing methods (e.g., checklists) before being critically prepared to evaluate instinctively.

Methodology

Participants

Population of this research study encompassed a convenience small group of language teachers who were taking the MA in Applied Linguistics to the Spanish as a Foreign Language at a Private University (Bogotá, Colombia). Six participants were voluntarily chosen to whom a needs analysis data-collection instrument was administered in order to determine their expertise when selecting CALL materials coherent with their class' language teaching approach. Additionally, a semi-structured interview was applied to a language college professor, which sought to explore and deepen on her experiences and practices on this same issue. Finally, a single participant of the target population was selected to review and pilot test the resulting products of this project.

Research Design

The methodological approach was guided by a mixed qualitative and quantitative research paradigm (Hernández, Fernández, & Baptista, 2006; Tashakkori & Teddlie, 2003) that made use of a four-phase sequential procedure to have a better comprehension of the research problem and, thereafter, to develop and validate the resulting products of this project (i.e., the websites' evaluation checklist and the study guide).

This implied starting with a *qualitative stage* that aimed at exploring, identifying and understanding the initial variables of the study in order to gain insights into the problem and propose a possible solution (Hernández et al., 2006). Thus, in the first place, a semi-structured interview was done and audio-recorded, then it was transcribed so that researchers could read through the raw data, recognize recurring themes and find relations among them, to finally interpret them and set core categories or variables. Later on, an open-ended questionnaire was conducted and analyzed following the same procedure applied to the interview. The last step was executing a data triangulation process (Patton, 1990; Tashakkori & Teddlie, 2003) by which findings collected from these both methods were compared and verified, and subsequently confronted with relevant literature in order to corroborate its validity and seek for possible convergences and divergences among them. This resulted in a series of problematic issues that allowed researchers to have a general comprehension of the nature of the research problem and thus to set an appropriate research question as well as the objectives that would lead this study.

Afterwards, this project followed three *quantitative stages* that mainly focused on measuring and controlling the variables (Fernández & Baptista, 2006) resulting from judging the quality and suitability of the proposed Checklist model and the Study guide so as to improve them.

Therefore, during the first stage, a survey adapted from Yang & Chan (2008) was applied to the Checklist model by one expert in the CALL field which, through a content and construct validity assessment (Kelley, 1999; Rubio, Berg-Weger, & Tebbs, 2003), researchers sought to revise whether the evaluation criteria and descriptors corresponded to each other and if these latter were appropriate, representative, important and clear for the criteria they stood for (i.e., technical, pedagogical-contextual and communicative approach-related characteristics) (see Appendix A). Then, after having refined the checklist proposal based on the expert's judgments, in the second stage, the instrument was pilot tested by one of the participants who applied it to a language website; this same was conducted by researchers in order to verify its inter-rater reliability (Seliger & Shohamy, 1989). Finally, in the third stage, the same participant evaluated both products by means of a survey that inquired about the quality of the study guide as an instructional material and for the checklist structural properties (see Appendix B).

Findings

Major outcomes from the four-phase procedure conducted in the present research are reported.

Phase I (qualitative stage)

The first stage was an application to the target population of an open-ended questionnaire and a semi-structured interview to a language college professor, both in the form of a needs analysis that focused on identifying and gaining an in-depth understanding of the research problem. Thus, the gathered information from these collecting instruments served to establish four core categories that became the following orienting problematic issues: (a) the steadily increasing number of websites grounded on a behaviorist language-learning theory; (b) its interface design that, unlike paper-based language materials, should integrate features such as *hypertextuality, multimedia, hypermedia* and some others, so as to promote communicative achievements; (c) the mismatch found between the teachers' choice of apparently communicative-based language websites and the ones that truly work for this purpose; and finally, (d) the lack of an evaluation instrument that allows language teachers to obtain a true understanding of what a communicative language website should look like. Table 3 displays a sample of the triangulation matrix used to correlate data resulted from both collecting instruments and its confrontation with literature.

The emerging research issues presented led researchers to draw the conclusion that there was a pressing need to propose an evaluation instrument for websites that comprises the principles of the Communicative approach, and that additionally focuses on what students will be able to do within this virtual environment as active participants of their own learning process. This would be with the aim of guiding language educators to make a reliable and informed decision on the most appropriate online material to integrate into class and as a brief training for them to progressively develop their Knowing-how-to-do skill. Thus, right after conducting the need analysis and interpreting the gathered results, researchers started to review literature with the purpose of targeting the first immediate need, which was the development of an initial checklist model. They analyzed and synthesized various checklists evaluation proposals (Table 1) that accounted for what have been done and said about assessing language-learning websites and its intrinsic properties (e.g., structure, organization, functionality, multimedia, content, language learning focus and son on). Based on this review process, it was found that most of the striking features included within these proposals were directly linked to technical aspects, followed by some pedagogical considerations and by a few language approach statements still limited to the linguistic competence, as it can be seen in Table 4.

Table 3: Triangulation matrix sample

Category	**Direct responses**		**General overview of the revised literature**
	Participants of the target population (survey responses)	**Language college professor (interview responses)**	
Behavior-ist-based Websites	Teacher 5: "*considerar la retroalimentación inmediata como fuente de conocimiento*" (to consider **immediate feedback** as a source of knowledge). Teacher 1: "*ejercicios de completar los espacios en blanco*" (**fill in the gaps** exercises). Teacher 6: "*generalmente se encuentran ejercicios de rellenar huecos, ya sea con información dada de manera escrita o de archivos de audio*" (generally, it can be found **fill in the gap exercises** to be solved with written or audio file input). Teacher 4: "*en Internet se pueden encontrar una variedad de ejercicios para las habilidades receptivas y la mayoría son ejercicios gramaticales mecánicos. Casi no encuentro ejercicios para la producción oral*" (On the Internet you can find a variety of exercises for the receptive skills and most of these are **mechanical grammar exercises**. I **hardly find exercises for oral production**). Teacher 1: "*hay mucha información en la Red, sin embargo, está se encuentra desorganizada*" (there is **a lot of information** on the Web, however it is **disorganized**).	"*se llamaban ejercicios interactivos pero ya con el tiempo me di cuenta de que no eran tan interactivos como pensaba, se brindaba la respuesta correcta y ya*" (these were called interactive exercises but I eventually realized that **they were not as interactive as I thought**, they only provided the **correct answer**). "*lo que había eran paginas enfocadas a las formas lingüísticas…no hay un reto más allá y el estudiante no ve la lengua como instrumento para comunicarse*" (there were websites focused mainly on linguistic forms…these did not imply any challenge and the student could not regard the language as a tool for communication). "*el profesor de lenguas…se siente como bombardeado por tanta información que hay en la red*" (the language teacher…feels overwhelmed by so much information on the Web).	García (2000) claims that a wide number of websites focus on providing grammatical explanations through structuralist exercises, which ultimately relegates the language communicative component. Likewise, Kartal (cited by Kartal & Uzun, 2010) outlines that a great number of language learning websites have narrowed their pedagogical approach to structural exercises with immediate feedback response. Moreover, Martín (cited in Cruz, 2003) indicates that most of the language exercises with an interactive look still being traditional, structuralist-based. Thus, the majority of those kinds of online materials offer exercises that enhance a deductive language learning approach, favored by the ease of programming of authoring programs such as Hot-potatoes and Web-practest (E. Fernández, 2007). Additionally, the growing offer of free-access website on the Net does not directly means quality (Susser, 2001; Yang & Chan, 2008; Son, 2005; Hassan & Fakulti, 2011).
Interface design qualities	Teacher 6: "*los criterios que tendría en cuenta para seleccionar un sitio web serían la interactividad y la lecturabilidad*" (the criteria I would take into account when selecting a website will be interactivity and readership). Teacher 1: "*que los sitios web no tengan problemas de plugins*" (websites must not have plugin failures). Teacher 2: "un sitio web debe tener practicidad" (A website must entail practicality). Teacher 5: "*No sabe / No responde*" (do not know /do not answer – this was given as a response to the question that inquired for the criteria participants that take into account when choosing a language website).	(Nothing was mentioned in this respect).	Internet-based materials can be commonly evaluated under the same criteria used for paper-based resources, due to the apparent familiarity between both of them. In this regards, Levy & Stockwell (2000) argue that, unlike textbooks that imply a linear reading, websites for its hypertextual nature need to be evaluated based on its intrinsic capabilities, which is why teachers must be third-party evaluators of this kind of material. A learning material cannot be limited to the format; instead, it must be adapted to the audiovisual culture supported by multimedia and hypertextuality online properties (Cruz, 2002).

Category	Direct responses		General overview of the revised literature
	Participants of the target population (survey responses)	**Language college professor (interview responses)**	
Teacher's mis-matching choice of websites	Teacher 2: "*Me encanta Duolindo, es interactivo y comunicativo*" (I love D**uolingo, it is interactive and communicative).**	"Recuerdo muy bien una página que a mí me parecía perfecta…entonces me di cuenta que realmente los estudiantes no estaban haciendo ningún tipo de negociación ni un intercam-bio significativo" (I re-member a website that seemed to be perfect…then I realized that **students weren't actually making any sort of communicative exchange**).	Warschauer (cited by Chapelle & Hegelheimer, 2004) argues that there is a need to rethink the communication competence in virtual environments. It is worth noting that Duolingo is a crowdsourcing platform that encourages students to learn the target language by translating words and phrases from their mother tongue and vice versa.
Lack of an as-sessment instru-ment	Teacher 1: "una herramienta de evaluación permitiría facilitar mi labor como docente de lengua" (**An assessment tool would make easier my work** as a language teacher). Teacher 3: "sería bueno contar con una herramienta…que me ayude a escoger un buen sitio web, dado que hasta el momento no conozco esos sitios muy bien" (It would be nice to have **a tool**… **that helps me to pick a good website,** given that so far I don't really know those sites that well). Teacher 5: "nunca me he detenido a evaluar la concordancia de las páginas que uso con lo que hago diariamente en mis clases, entonces sería bueno tener una herramienta de evaluación para este propósito" (I have never considered evaluating the coherence between the websites I use daily in my classes, so it would be great to have an assessment tool for this purpose).	"*yo creo que es bastante importante que se pudiera tener un recurso…para que encuentre una página que realmente le permita pre-sentarle a sus estudiantes un material de apoyo de calidad… en donde las instrucciones sean claras, sencillas y que sobre todo permita el uso real de la lengua*" (I think it's quite important to count on with a **resource**…to **find a websi-te** that truly allows teachers to provide students with a **quality** supporting mate-rial…where instructions are clear and overall, leads to the **real use of the langua-ge**).	According to Higueras (2010) and Magúsdóttir (2010), the large amount of free-access websites possess a problem of discrimination for language teachers, being this the reason why, there is a need to count on with a clear set of criteria that allow educators to make valuable judgements on the most appro-priate websites for the intended teaching purposes. Fotos & Brown (2004) note that "language teachers are increas-ingly required to possess CALL expertise that includes both practical skills and a thorough understanding of information technology theory. Teachers may need to design, implement and evaluate CALL activities in their classroom" (p.3). The same is considered by authors such as Son (2005); Levy & Stockwell (2006), Chapelle (2001).

Table 4: Website evaluation proposals

Dimension	Websites features / items		Authors
Technical aspects	- Authority - Authorship - Accuracy - Navigation - Interface	- Usefulness - Edition settings -Genealogy or source origin - Loading speed	Stoker & Cooke (1994), Marquès, (1999), Lázaro & Fernández (2000), Son (2005), Aly (2008), Yang & Chan (2008), Higueras (2010), Kartal & Uzun (2010), Dogoritti & Pagge (2012)
Pedagogical considera-tions	- Learning materials - Content - Difficulty level of activities	- Evaluation information - Learners' preferences - Contextual characteristics	Marquès (1999), Trenchs Parera (2001), Yang & Chan (2008), Higue-ras (2010), Kartal & Uzun (2010)
Language approach principles	- Language skills	- Feedback delivery - Communication setting	Son (2005), Yang & Chan (2008), Lozano & Ruiz Campillo (2009), Higueras (2010)

Once the literature has been reviewed and researchers have chosen the specific items to include within the Checklist proposal, it was necessary to conduct an additional exploratory search on current Spanish learning websites (e.g., Español para extranjeros *http://www.aurora.patrick-nieto.fr/*, RedMolinos *http://www.redmolinos.com/*, ver-taal *http://www.ver-taal.com/*, La ruta de la lengua española *http://www.larutadelalengua.com/index2.htm*, etc.) in order to observe their capabilities and limitations and thus to derive extra features. This whole process resulted in a preliminary Checklist model that encompassed nine evaluation criteria and a total of 40 descriptors included within three evaluation dimensions, as referred as follows:

1. *Technical characteristics* related to the ease of use (7 descriptors) and reliability criteria (3 descriptors).
2. *Pedagogical contextual characteristics* referring to the content quality criterion (5 descriptors) and the material potentiality criterion, this latter in terms of the provided advantages and benefits (2 descriptors).
3. *Communicative Approach-related characteristics* that reflected on criteria such as autonomy (4 descriptors), language contextualization (5 descriptors), language skills integration (6 descriptors), interculturality (4 descriptors) and interaction (4 descriptors).

Finally, it is important to mention that, during this first stage, a theoretical framework concerning the Communicative Approach principles, the language websites' features and Digital Competence was also taken into account with the purpose of: (a) conducting the triangulation procedure (see Table 3); and (b) establishing the orienting checklist dimensions (i.e., evaluation criteria) along with its descriptors; in particular, the ones implying the *Communicative Approach-related characteristics*.

Phase II (quantitative stage)

A four-part validity survey that sought to improve the quality of the preliminary evaluation criteria and descriptors was applied to an expert in the CALL field. This data collection instrument, adapted from Yang & Chang (2008), asked to carefully revise, rate and provide comments or suggestions for each of the evaluation components that comprised the preliminary proposal. This included judging the appropriateness (i.e., the suitability of a descriptor in relation to the criterion it was proposed for), representativeness (i.e., the descriptor stands for the criterion it was proposed for), importance (i.e., the relevance of the descriptor for the respectively criterion), and clarity (i.e., avoid wording ambiguity) of descriptors, as well as checking their belonging to the proposed criteria (see Appendix A).

The results from this survey (see Figure 1) showed that the evaluation dimension regarding the *Technical aspects* received an overall assessment of 99.4%, since the descriptors encompassed within the "ease of use" and "reliability" criteria were 100% representative, important and appropriate, and 97.5% clear. However, the reviewer recommended that there should be more descriptors concerning the hardware-software technical specifications (ease of use criterion) and one item that inquires for the author(s) of the website (reliability criterion).

On the other hand, the *Pedagogical contextual* dimension obtained an 85.7% valuation, as its descriptors were 96.4% representative, 89.2% important, 85.7% clear and 71.4% appropriate. This revealed that it was necessary to make descriptors more comprehensible and shorter, this by including exemplifications, clarifications, etc. (content quality criterion); likewise, descriptors implying the advantages and benefits of the website could be deleted as they are taken up in subsequent descriptors (material potentiality criterion).

Finally, concerning the *Communicative Approach* dimension, it could be observed that it got an 82.6% of accomplishment, as its descriptors showed to be 79.3% representative, 82.6% important, 90.2% clear and 78.2% appropriate. In this respect, the expert asserted that: (a) the descriptor about evaluation should be formulated in a way that does not purely imply test taking but a more formative assessment process (autonomy criterion); (b) some of the descriptors tend to make emphasis on linguistic and lexical properties and do not take into consideration other aspects that could promote authentic communication exchanges (language contextualization criterion); (c) three descriptors do not account for the language skills integration (language skills integration criterion); (d) descriptors should include the notion of attitude as one of the important aspects involved in the learning of the target culture (interculturality criterion); and (e) some of the descriptors focused mainly on the machine-student interaction and did not express real exchange of meanings, so for this reason they should be integrated into a new criterion that embraces feedback-delivery (interactivity criterion).

These outcomes were of great help to researchers for gathering useful and important feedback on how well-founded and accurate were the initial evaluation criteria and descriptors. Thus, from this validity survey, 11 evaluation descriptors were revised and improved, and other 19 were incorporated. Even though the findings showed that some of them had wording problems and needed to be rewritten again, they were still appropriate, representative and important.

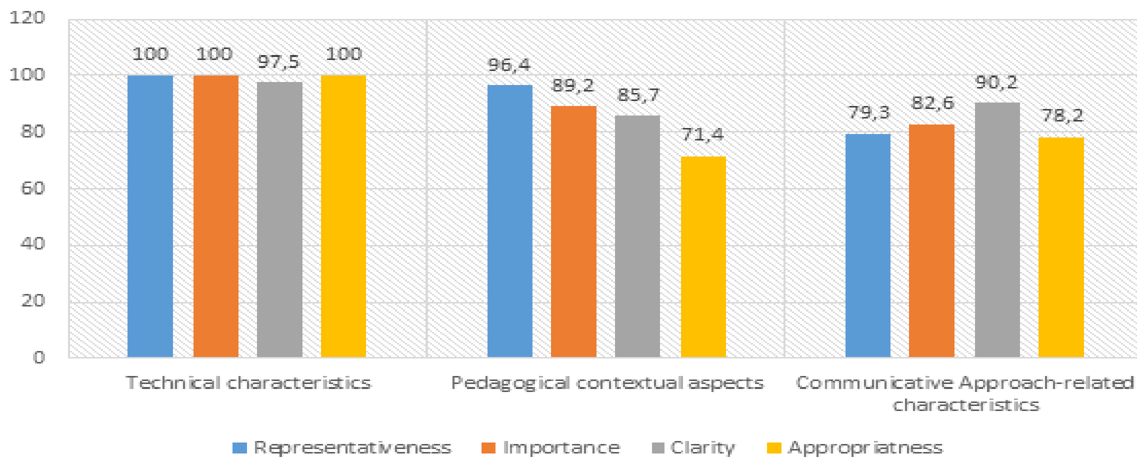


Figure 1: Expert rating over preliminary Checklist proposal

In light of the above, researchers were able to refine the preliminary Checklist model (see Appendix C) and obtain an evaluation tool that comprised a total of 49 descriptors integrated into the three already known dimensions and eight evaluation criteria. This instrument can be used by reviewers or third-party evaluators to judge the value and quality of any language-learning website by simply checking off "Yes" or "No" in the given grid as well as adding some personal comments based on the degree to which the online material meets the intended communicative teaching objectives. Table 5 explains in detail each of the final checklist's components.

Apart from the Checklist model, the other goal of this research project was to strengthen the teachers' Knowing-how-to-do skill as part of their Digital Competence. This was attempted to be accomplished by designing a Study Guide (https://issuu.com/sthephannymoncadalinares/docs/guiapracticafinal), as a training and informational instructional material that could provide a conceptual and practical framework along with methodological suggestions for educators to become familiar with language-learning websites just before evaluating them.

Table 5: Checklist evaluation model

<table>
<tr><td>Technical features dimension
Allow users to recognize at first sight, whether the website is worth exploring and if it serves as a complementary material for the classroom use.</td><td>Pedagogical context features dimension
The opportunities offered by the website to facilitate learning and how it adapts to complement the learners' needs and interests in relation to the contents, activities and extra resources.</td></tr>
<tr><td>14 Descriptors:
• Ease of use criterion (9 descriptors): It covers the website qualities in regards to a friendly, clear, simple, consistent, attractive and motivating graphic interface, aspects that directly affect the user's browsing experience. Therefore, websites for itself should be self-explanatory and not possess any difficulties when browsing it, retrieving information, obtaining learning materials or following hyperlinks.
• Reliability criterion (5 descriptors): It shows that a website is credible when it is possible to identify its developers, it does not present any systematic errors that hinder navigation and hyperlinks do not connect to other dubious sites.</td><td>5 Descriptors:
• Quality of contents criterion (5 descriptors): it encompasses a variety of integrated content, activities and resources while indicating its level of complexity. Additionally, it should present the learning objectives to be achieved with the completion of any activity or exercise, as well as the corresponding explanations and clear instructions that guide users without the need to require an external supervision.</td></tr>
<tr><td colspan="2">Communicative Approach theoretical dimension
This criterion aside from being proposed based an approach-driven framework (i.e., Communicative Approach), its descriptors target at describing what students are able to do within the website in terms of Low or High Order thinking skills (Anderson & Krathwohl, 2001).</td></tr>
<tr><td colspan="2">30 descriptors:
• Autonomy criterion (4 descriptors): It should promote a self-learning, self-monitored and self-regulating space by the inclusion of hypertextuality and rich contextual hypermedia.
• Language contextualization criterion (7 descriptors): It should introduce language input inductively and additionally, enhance it (e.g., capital letter, boldface, underlining, italics, etc.). Activities and exercise must have an implicit communicative intention and should be supported by various multimedia and hypermedia resources that contextualize knowledge.
• Language skills integration criterion (7 descriptors): In real communication exchange the four language skills are integrated, that is why a language website should ideally encompass authentic materials, multimedia, hypermedia and CMC tools to achieve this goal. However and differing from an e-Learning platform, researchers are aware that most websites have some intrinsic limitations in this regards, being the reason why they commonly integrate a wide range of receptive skills activities.
• Interculturality criterion (8 descriptors): through the integration of hypertext, multimedia, hypermedia and authentic materials, websites are able to recreate a living and dynamic context where culture is present.
• Evaluation criterion (4 descriptors): the possibility to receive automatic feedback that allows users to self-monitor and observe their performance when solving different exercises or activities. Some websites apart from the right/wrong remark, place allusive phrases about what students will be able to do or include assessment rubrics.</td></tr>
</table>

The main structure of this created material consists of four sections plus a glossary and a reference part:

- *Section 1 - What do language teachers need to know?* Fundamental concepts related to the notion of Digital Competence, Communicative Approach, websites and its main features (hypertext, multimedia, hypermedia, and feedback tools CMO) are presented.
- *Section 2 - What are we looking for in language learning websites?* The Communicative Approach principles (i.e., autonomy, contextualization of language, integration skills, intercultural interaction and assessment) are displayed in the form of evaluation criteria and descriptors, as they appear in the checklist. This with the aim of illustrating what might possess a certain language website if it is highly communicative. Thus, each descriptor is

accompanied by a screenshot that represents the available features or resources that meet the teaching and learning expectations, so it can give a visual idea of what evaluators are looking for.

- *Section 3 - It is time to evaluate:* The assessment instrument (checklist) is presented along with its corresponding instructions.
- *Section 4 - Let's talk about design:* In order to help direct the work of the reader to a practical exercise, a number of methodological suggestions for the creation and design of a website are provided as an opportunity to put into practice the knowledge acquired throughout the material.
- *Glossary:* The definitions of eleven terms that may be new to the reader are organized in alphabetical order, giving conceptual clarity of the technicalities referred in the material (e.g., Web search engine, web page, URL, hyperlink, interface, among others).
- *References.*

This Study Guide was also reviewed by a professional in the language-teaching field, to whom an evaluation survey was administered consisting of 20 questions (see Appendix B). This evaluation was performed in a space of two hours, where the college professor revised the whole instructional material and then completed the survey format. The results showed that most of the material's sections met the objectives for which they were developed, reaching a total score (i.e., over four points - 100%) on aspects such as: (a) *impact* on arousing and sustaining the reader's curiosity and attention by providing attractive presentation, appealing content and activities that boost their active thinking; (b) encouraging readers to *feel at ease* when facilitating the understanding of contents by including exemplifications, illustrations and other contextualizing resources; (c) developing readers' *self-confidence* by pushing their skills and knowledge beyond their existing proficiency through activities with a progressive level of difficulty; and (d) promoting *self-instruction*. On the other hand, it obtained 3 points (87.5%) on its capability of offering *useful and relevant* contents. It is important to mention that these criteria used for evaluating the Study Guide was adapted from Tomlinson's (2011) principles to design effective language-teaching materials.

Furthermore, as the checklist was also part of the Study Guide (section 3), the language professor was asked to judge and evaluate its overall content, from which it received a rating from three to four points in items such as: (a) its structure (three points); (b) the clarity of its instruction delivery (four points); and (c) the quality of its descriptors (four points). The evaluation results from both products can be seen in Table 6. The outcomes from this second phase of the study allowed researchers to make improvements to the Checklist and the Study Guide before implementing them in a real setting.

Table 6: Language college professor rating on the Study guide and the Checklist model

Evaluation criteria	Given rating	General remarks from the participant
STUDY GUIDE		
Materials' impact	100% (4 points)	"en la guía se presentan imágenes, glosario, explicaciones. Hay llamados o sección "para pensar". Se observa una secuencia lógica en la presentación de los contenidos. La presentación de información teórica le ayuda al docente a desarrollar la autoconfianza" (the guide displays images, a glossary, explanations. There is a section called "to think." There is a logic sequence in the exhibition of contents. The presentation of theoretical information helps teachers to develop self-confidence).
Teacher's development of self-confidence	100% (4 points)	
Teacher's feeling at ease	100% (4 points)	
Perception towards the displayed contents as relevant and useful	87.5% (3 points)	
Teacher's self-instruction	100% (4 points)	

Evaluation criteria	Given rating	General remarks from the participant
CHECKLIST MODEL		
Structure	91.6% (3 points)	"En general, la lista de chequeo presenta los criterios de evaluación de forma y concisa. Por su parte, los descriptores son fáciles de entender y están organizados de manera secuencial" (In general, the checklist presents contents in a clear and concise way. For its part, descriptors are easy to understand and are organized in a sequential fashion).
Clarity of instructions	100% (4 points)	
Quality of the evaluation descriptors	100% (4 points)	

Phase III (quantitative stage)

With the purpose of applying and testing the quality and efficacy of the proposed Checklist model, it was necessary to pick one language-learning website. The selection was conducted by typing in the Google search engine entries like "Spanish language-learning websites", "the best language websites to learn Spanish", etc.; then, from the wide array of possibilities and after skimming and scanning some of the retrieved sites that were free access no-cost, reliable and useful as they integrated a variety of contents, activities and resources, the "*Español para extranjeros*" (http://www.aurora.patrick-nieto.fr/) website was chosen.

During this third stage of the research, one participant of the target population was asked to use the Checklist in order to evaluate the previously selected online environment. First, she received a copy of the Study Guide for her to read thoroughly; then, she was requested to familiarize with the site, surfing and exploring its various options and pathways; and finally, she was encouraged to apply the evaluation instrument to this site.

Findings regarding this assessment process showed that, in general, the website accomplished in 60.7% the descriptors encompassed within the three evaluation dimensions (i.e., technical, pedagogical-contextual and the Communicative Approach-related characteristics), being ranked as a "Good (appropriate for use)" complementary material for meeting 29 out of 49 evaluation items.

Thus, within the dimension of *technical features*, the site met in 59% the evaluation criteria, as it proves to have free and no-cost access, it is easy to use as it displays a friendly and attractive interface that provides navigation guidance to users, makes use of a clear and precise language and, in addition, has an appropriate balance between the textual and multimedia content. However, browsing can be a bit difficult because it lacks permanent frames that allow the use of its independent controllable sections. On the other hand, the site seems to be reliable as it is claimed to be the result of a teaching project developed by its authors, who pointed out that it is founded on the constructivism and notional-functional theoretical framework; nonetheless, information related to its permanent updating is not presented.

Some of the participant's comments that support her rating over this category include: "*no veo las pestañas*" (I don't see the tabs), "*yo le añadiría otros colores un poco más vivos*" (I would add more vivid colors), "*los enlaces son muy llamativos*" (the hyperlinks are too eye-catching), "*veo que en algunas ocasiones el azul y el morado se confunde en las instrucciones y en los títulos*" (I see that sometimes blue and purple blends into the instructions and the titles), "no lo veo ni es visible para mí la actualización" (the uptading option isn't visible for me), and "*se basa en las teorías de Piaget y Vigotsky, tal como se señala*" (it is based on Piaget and Vigotsky's theories, just as it is indicated).

In regards to the dimension of *pedagogical-contextual characteristics*, the website reached a success rate of 60%, since it includes a variety of contents, activities and resources, displays short and understandable instructions and introduces grammar points inductively. Nevertheless, it does not present the learning objectives pursued by the realization of the different activities and exercises nor indicates its language level of difficulty, as the participant underlines: "*no hay objetivos planteados al inicio de cada tarea ni su nivel de lengua*" (neither the goals nor the language level are presented at the beginning of each task).

Finally, in relation to the *Communicative Approach principles* dimension, the website got a 63% of success, meeting 17 out of 30 evaluation descriptors. It proves to have a stronghold in promoting autonomy, language contextualization and evaluation, as it allows students to freely choose and make decisions on the pathways they are interested in following within or outside the site, it offers different types of resources (e.g., multimedia, authentic materials, etc.) that contextualize knowledge and facilitates the understanding of the target language, and additionally provides both explicit and implicit feedback that favor the recognition of the students' strengths and weaknesses. Nonetheless, it fails to provide tools (e.g., evaluation rubrics) for monitoring their own language learning performance in terms of productive skills.

It is worth noting the website has some disadvantages when trying to successfully foster interculturality and interaction as, for example, it relies on a single sociocultural perspective coming from the peninsular Spanish and does not take into consideration other Spanish speaking regions; likewise, it does not integrate or link users to other sites that encompass CMC tools that could approach them to interact with people and thus promote authentic and meaningful learning situations, as evidenced by the participant who asserted that "*en los ejercicios que exploré, yo no encontré herramientas CMO*" (within the exercises that I explore, I couldn't find CMC tools). It also has some weaknesses with respect to the integration of language skills, because it does not include authentic sounds, such as songs and everyday dialogues, that could enhance the oral comprehension and, on the contrary, it mainly focuses on receptive skills. However, this site does provide learners with a series of printable complementary activities that offer practical application of the language communicative skills and, despite being paper-based, they can successfully enhance oral communication by means of teamwork activities in class.

Table 7 portrays the results obtained from evaluating this site and compares the participant and the researchers' results, who also evaluated it with the purpose of testing the inter-rater reliability of the Checklist model in relation to the consistency and accuracy between both responses.

Table 7: Results of evaluation of the website *Español para extranjeros*

Dimension	Criterion	Participant's results		Researchers' results	
		Items	Percentage (%)	Items	Percentage (%)
Technical features	Ease of use	7/9	77,7%	8/9	88,8%
	Reliability	2/5	40%	3/5	60%
	Total	9/14	**59%**	11/14	**74,4%**
Pedagogical contextual characteristics	Contents quality	3/5	60%	3/5	60%
	Total	3/5	**60%**	3/5	**60%**
Communicative approach-related characteristics	Autonomy	4/4	100%	4/4	100%
	Language contextualization	6/7	85,7%	6/7	85,7%
	Language skills integration	3/7	42,8%	3/7	42,8%
	Interculturality	1/8	12,5%	1/8	12.5%
	Evaluation	3/4	75%	3/4	75%
	Total:	17/30	**63%**	17/30	**63,2%**
	Final score:	29/49	**60,7%**	31/49	**65,8%**

Phase IV (quantitative stage)

After the application (pilot testing) of the Checklist and the corresponding review of the Study Guide conducted by one of the participants of the target population, a 24-question evaluation survey was administered to her as a final stage of this research project (see Appendix B). This data-gathering instrument contained some of the questions that were also asked in the previous stage to the expert, so, it asked about the material's capacity to achieve impact on learners, to make them feel at ease, to develop their confidence, to be relevant and useful as well as to promote self-instruction. There were also 9 questions regarding the Checklist's overall structure, the clarity of its instructions and the quality of its descriptors and an additional set of 4 open-ended questions, which asked for the contributions, advantages, disadvantages and possible future use of this evaluation instrument.

The results from the survey indicated that both materials – the Study Guide and the Checklist – met the objectives for which they were created, receiving a score of three or four points in each of the listed items (over a total of four points) (see Table 8). Thus, the former can contribute with augmenting the teachers' Knowing-how-to-do skill by providing theoretical and practical input for them to be aware about the several possibilities websites can offer for language students, as well as to know what to look for in these online materials when selecting the most appropriate one. Indeed, the respondent stated that the Guide serves as a starting point to venture in the digital world and bring it to the classroom setting, since she just started gaining knowledge and skills in the CALL evaluation field. On the other hand, the latter was regarded as a useful instructive tool that leads to reflect on one's own beliefs and opinions about the nature of the target language, language teaching and learning and the capacity of virtual spaces to support and enhance this process. It was highly valued (four points out of four) for not only focusing on the structural features of a website but also comprising aspects related to language learning and the students' active and constructive involvement while surfing on it, as reflected on the evaluation descriptors that account for the Communicative Approach principles.

Table 8: Participant's rating on Study Guide and Checklist

<table>
<tr><th>Evaluation criteria</th><th>Given rating</th><th>General remarks from the participant</th></tr>
<tr><td colspan="3">STUDY GUIDE</td></tr>
<tr><td>Materials' impact</td><td>100%
(4 points)</td><td rowspan="5">- "como docente de inglés y que no he tenido la experiencia de enseñar español, la exploración de este sitio me brindó herramientas para comenzar mi experiencia como profe digital y desde luego, evaluar objetivamente los recursos virtuales" (As an English teacher and I have not had the experience of teaching Spanish, the exploration of this site provided me with tools to start my experience as a digital teacher and certainly, to objectively evaluate virtual resources).

- "algunas de las ventajas de este material son: los conceptos y la aclaración de dudas referentes al sitio web" (some of the advantages of this material are the concepts and clarification of doubts concerning the website).

- "las desventaja son: falta de tiempo para explorar este sitio a cabalidad y así emitir un mejor juicio valorativo" (the drawbacks are lack of time to fully explore the website and thus, to provide a better value judgement).</td></tr>
<tr><td>Teacher's development of self-confidence</td><td>100%
(4 points)</td></tr>
<tr><td>Teacher's feeling at ease</td><td>100%
(4 points)</td></tr>
<tr><td>Perception towards the displayed contents as relevant and useful</td><td>100%
(4 points)</td></tr>
<tr><td>Teacher's self-investment</td><td>100%
(4 points)</td></tr>
</table>

<table>
<tr><th>Evaluation criteria</th><th>Given rating</th><th>General remarks from the participant</th></tr>
<tr><td colspan="3">CHECKLIST MODEL</td></tr>
<tr><td>Structure</td><td>100%
(4 points)</td><td rowspan="3">- “sus fortalezas son: claridad de los descriptores, información precisa y concisa. Volvería a utilizar este instrumento de evaluación con base a los criterios de este material podré formar ideas and bases para mejorar mi proceso de evaluación de materiales de lengua” (its strengths are the clarity of descriptor, the information is precise and concise. I would use this evaluation instrument again and based on the criteria displayed on this material, I will be able to build ideas and fundaments to improve my process of assessing language materials).
- “definitivamente los descriptores presentados son representativos para esta medición porque nos orientan en el proceso de evaluación de cada principio del enfoque comunicativo” (definitely, the displayed descriptors are representative for this measurement because they guide us in the evaluation process of each principle of the Communicative approach).</td></tr>
<tr><td>Clarity of instructions</td><td>87.5%
(3 points)</td></tr>
<tr><td>Quality of the evaluation descriptors</td><td>100%
(4 points)</td></tr>
</table>

It is noteworthy that the main disadvantage found by the participant when evaluating the Spanish language-learning website was that it is time consuming exploring it as a whole, because in order to get an accurate judgment on its worth and quality it is advisable to follow every pathway and even solve most of its activities and exercises. Table 8 displays the overall results of both evaluated materials.

Discussion

The present study has given a first step toward providing an approach-based Checklist model proposal that guides teachers to make an informed decision on the most suitable Communicative language-learning websites, while at the same time they strengthened their Knowing-how-to-do skill. This was accomplished by conducting a four-phase research procedure from which findings suggested the following.

Primarily, it can be stated that the application of the Checklist to a selected language website and the usage of the Study Guide by one of the participants of the target population shed some light on the enhancement of her digital competence, mainly on the Knowing-how-to-do skill. Thus, it could be observed that the participant was able to make use of her critical and reflective abilities to appropriately addresses the evaluation of a website by judging its worth and suitability both quantitatively (i.e., numerical judgements) and qualitatively (i.e., open-ended commentaries). In fact, comparing the score she gave to the site, it can be evidenced that her ranking only differed in 5.1% from the researchers' appraisal, which demonstrated her capability to become a third-party evaluator (Levy & Stockwell, 2006; Nomdedeu, n.d.) despite her lack of experience conducting this type of assessment and the short time given to do it.

On the other hand, the participant recognized how the theoretical insights provided by the Study Guide were of a great support not only to do the practical task (i.e., evaluate a website) but also to obtain a better understanding of websites technical language, allowing her to additionally, improve her Knowing learning domain that initially seemed to be shallow and limited (Lara, 2012). Hence, in a near future she might not probably have to base her decisions on an evaluation instrument but rely on her own practical and theoretical knowledge.

Likewise, findings from pilot testing the proposed Checklist model showed that, in general, this instrument served as a starting point to (a) foster educators' coherence between the language learning theory in which they base their teaching and the online materials they implement in class; (b) locate the language websites that best encourage the development of the learners' communicative competence (Hassan & Fakulti, 2011; Son, 2005; Susser, 2001; Yang & Chan, 2008); and (c) enhance the Knowing-how-to do skill of the evaluator. Furthermore, this tool also attempted to enrich the teachers' practices by allowing them to identify which Low or High Order Thinking Skills will learners probably activate when surfing a language website (Campoverde, 2006), what is possible due to the nature of the evaluation descriptors presented in the Communicative approach dimension of the Checklist, even though this can only be evidenced by conducting a future empirical assessment (Chapelle, 2001; Reeder et al., 2004; Squires & McDougall, 1996).

In respect to the overall results obtained by the Spanish website "*Español para extranjeros*" evaluated under the parameters of the Checklist model, it demonstrated to be a well-founded site, with no large structural failures, that bases its instruction on communicative language learning principles up to the level that its internal properties allow. Clearly, its designers were aware of providing users with material that goes beyond the traditional focus on forms associated with authoring programs and, conversely, seeks to encourage learners to use the target language to produce and negotiate meanings (Brown, 1994), even if it implies proposing printable resources for classroom use. Therefore, by incorporating elements such as multimedia, hypertextuality and hypermedia, this website manages to offer meaningful and contextualized input that promotes learner-centered processes and fosters the practice of receptive skills while delivering immediate feedback that leads to self-monitoring of learning performance.

However, it should be noted that these types of quality websites are difficult to find due to the hardware requirements, the time investment and the expertise of its creators in the language field; thus, for example, it needs to be designed by a group of interdisciplinary experts such as philologists, language teachers and computational linguists, who truly understand the learners' communicative needs and interests (Cruz, 2003; Torat, 2000), and not just allocate this task to web programmers.

From the above presented, it can be inferred that this research project implied on the one side, a theoretical importance as it contributed to the growing literature on the CALL evaluation area, specifically, on the assessment of online materials based upon the Communicative teaching approach principles because, unlike what most educators might think, a quality website cannot be defined solely on its apparent interactivity and provision of structuralist input. On the other side, it represented a practical relevance since its derived products, that is, the Checklist model and the Study guide, attempted to assist and guide educators in their pursuit of finding suitable and reliable materials that enhance learning processes while they gain expertise on this field. In this regards, for instance, the instrument can be adapted to evaluate e-Learning environments owing to most of its components (i.e., evaluation criteria and descriptors) being applicable to any online material and serves as well as a reference to create or improve the own setting; likewise, the instructional material for being information-rich, can be used by anyone who wants to augment his/her knowledge on technical language.

Finally, even with the present study serving as a cornerstone, there is still a need for further research in the fields of CALL evaluation and Digital competence enhancement; thereby, some recommendations on this respect include the following: (a) the study of students' learning outcomes after having used Communicative-based language websites, by conducting an empirical evaluation; (b) the assessment of an e-learning environment using the proposed Checklist model in order to judge the extent to which it truly fosters a communicative and meaningful language-learning process; (c) the updating or revision of the different Checklist's elements in the light of emerging language teaching approaches and the technological advancements in learning online materials; and (d) the development of instructional materials that seek to strengthen the language teachers' digital competence in its all learning domains, that is, the Knowing, Knowing-how-to-be and the Knowing-how-to do. Additionally, for upcoming projects based on a similar concern, a larger population size and a broader panel of experts should be included with the aim of having more robust data to analyze and thus to demonstrate higher levels of reliability and validity in findings.

Conclusion

The findings provided a more comprehensive picture of what to focus on when evaluating CALL materials and what are the possible benefits for the evaluator when embarking on this task. Thus, with the Checklist model and the Study Guide proposed as a result of this research project, language teachers are able to relieve the heavy burden they have in regards to selecting and integrating quality and suitable online materials that meet their communicative teaching objectives. Moreover, by getting involved in the evaluation process, the educators have the opportunity to continuously gain expertise on their practical skills and augment their technological knowledge.

Ultimately, this represents a win-win for the language teacher and student, as the former can speed up the search of appropriate learning virtual environments while enhancing their Knowing-how-to-do learning domain as part of their Digital competence, and the latter can profit from practicing the target language by means of supporting material that is eye-catching, motivating, easy to manage, reliable and that additionally, encourages to a higher extent communicative principles such as the autonomy, language contextualization, integration of the four language skills, interculturality and evaluation.

Acknowledgements

We appreciate the contribution of Prof. Ana Maria Rojas Fierro for guiding researchers on the development of this study as well as the participants and language-teaching experts who also contributed with their suggestions and opinions. Additionally, we wish to acknowledge the input of participants at the International Conference ICT for Language Learning, where a shorter version of this document was presented and, finally, recognize the valuable feedback provided by the editor and peer reviewers of the IJELL Journal.

References

Adell, J. (1995). La navegación hipertextual en el World Wide Web: Implicaciones para el diseño de materiales educativos [Hypertext browsing in the World Wide Web: Implications for the design of educative materials]. *II Congreso de Nuevas Tecnologías de la Información y Comunicación para la Educación,* Palma de Mallorca, Spain. Retrieved from http://nti.uji.es/docs/nti/edutec95.html

Anderson, L., & Krathwohl, D. (2001). *Taxonomy for learning, teaching and assessing: A revision of Bloom's Taxonomy of Educational Objectives*. New York: Longman.

Aly, M. (2008). *An evaluative study of some online websites for learning and teaching English as a foreign language*. Retrieved from http://files.eric.ed.gov/fulltext/ED499586.pdf

Area, M. (2009). Introducción a la tecnología educativa [Introduction to educational technology]. *Manual Electrónico.* Retrieved from https://campusvirtual.ull.es/ocw/file.php/4/ebookte.pdf

Campoverde, A. (2006). Guía de evaluación de educación inicial [Evaluation guide for initial education]. Retrieved from http://es.slideshare.net/luztejerina/guia-de-evaluacion-13641961

Canale, M., & Swain, M. (1980). Theoretical bases of communicative approaches to second language teaching and testing. *Applied Linguistics, 1*, 1-47.

Caridad, E. (2008). Características de los materiales web para la enseñanza y aprendizaje de lenguas extranjeras [Characteristics of web materials for teaching and learning foreign languages]. *Revista de Medios y Educación,* (31), 31-38. Retrieved from http://www.redalyc.org/articulo.oa?id=36803103

Chamorro, M. (2009). Integración de destrezas en niveles iniciales [Integration of skills in starting levels]. *MarcoELE*, (9), 33-52. Retrieved from http://marcoele.com/descargas/expolingua1996-chamorro.pdf

Chapelle, C. (2001). *Computer applications in second language acquisition: Foundations for teaching, testing, and research*. Cambridge: Cambridge University Press.

Chapelle, C., & Hegelheimer, V. (2004). The English language teacher in the 21st century. In S. Fotos & C. Browne (Eds.), *New perspectives in CALL for second language classrooms* (pp. 299-316). Mahwah, NJ: Erlbaum.

Chuo, S-C., & Kung, T-H. (2002). Students' perceptions of English learning through ESL/EFL Websites. *TESL-EJ, 6*(1). Retrieved from http://www-writing.berkeley.edu/TESL-EJ/ej21/a2.html

Codina, L. (2000). Evaluación de recursos digitales en línea: Conceptos, indicadores y métodos [Evaluation of online digital resources: Concepts, indicators and methods]. *Revista española de documentación científica, 23*(1), 9-44. doi: 10.3989./2000.v23.il.315.

Colpaert, J. (2004). Editorial: Transdisciplinarity. *Computer Assisted Language Learning, 17*(5), 459-472.

Cruz, M. (2002). Materiales para la ELE en internet: Análisis de 207 webs útiles para la enseñanza del ELE [SFL materials on the Internet: Analysis of 207 useful websites for SFL teaching]. In M. Cruz. *Enseñar español en la era de la internet. La WWW y la enseñanza del español como lengua extranjera* (pp. 97-154). Barcelona, Spain: Octaedro.

Cruz, M. (2003). Presencia (y ausencia) de los hipermedios y de los géneros electrónicos en las Webs para la enseñanza-aprendizaje del español como lengua extranjera (ELE) [Presence (and absence) of hypermedia and electronic genres in the Web in teaching-learning Spanish as a foreign language (SFL)]. *C & E: Cultura y educación, 15*(3), 311-325.

Díaz, C., & Moncada, S. (2014). *Evaluación y selección de sitios web coherentes con el enfoque comunicativo para el aprendizaje de ELE* (Master dissertation) [Evaluation and selection of SFL learning websites coherent with the communicative approach]. Colombia, Pontificia Universidad Javeriana. Retrieved from http://repository.javeriana.edu.co/bitstream/10554/15959/1/DiazRomeroAndreaCarolina2014.pdf

Duignan, P. (2003). Approaches and terminology in programme and policy evaluation: A New Zealand Reader. In N. Lunt, C. Davidson, & K. McKegg (Eds.), *Evaluating policy and practice.* Auckland, New Zealand: Pearson Education.

European Parliament and European Council. (2007). *Key competences for lifelong learning – A European framework*. Retrieved from http://www.alfa-trall.eu/wp-content/uploads/2012/01/EU2007-keyCompetencesL3-brochure.pdf

Fernández, E. (2007). *Las TIC en la clase de ELE. Interculturalidad y desarrollo afectivo. Propuesta de una Unidad Didáctica TIC para un aula de enseñanza de ELE afectivamente eficaz* (Master dissertation) [ICT in the SFL class. Multiculturalism and emotional development. Proposal for an ICT didactic unit for an effective SFL classroom teaching]. Internacional Menéndez Pelayo University, Madrid, España.

Fernández, S. (1988). Corregir y evaluar desde una perspectiva comunicativa [Correct and evaluate from a communicative perspective]. *Actas I de las primeras jornadas pedagógicas de ASELE,* 13-28. Retrieved from http://cvc.cervantes.es/ensenanza/biblioteca_ele/asele/pdf/01/01_0017.pdf

Ferrari, A. (2013). *DIGCOMP: A framework for developing and understanding digital competence in Europe.* European Commission. Retrieved from http://ftp.jrc.es/EURdoc/JRC83167.pdf

Fotos, S., & Brown, C. (2004). *New perspectives on CALL for second and foreign language classrooms.* Mahwah, NJ: Lawrence Erlbaum Associates.

García, G. (2000). *La ruta de la lengua española (una Web para la enseñanza-aprendizaje del español como lengua extranjera)* (Master dissertation) [La ruta de la lengua española (a Website for teaching-learning Spanish as foreign language)]. Salamanca University, Salamanca, Spain.

Gonzalo, C. (2006). Tipología y análisis de enlaces web: aplicación al estudio de los enlaces fraudulentos y de las granjas de enlaces [Typology and analysis of web links applied to the study of fraudulent links and link farms]. *Textos universitaris de biblioteconomia i documentació,* (16). Retrieved from http://bid.ub.edu/pdf/16gonza2.pdf

Instituto Cervantes. (2012). Las competencias clave del profesorado de lenguas segundas y extranjeras [Key competencies of second and foreign language teachers]. Retrieved from http://cfp.cervantes.es/imagenes/File/competencias_profesorado.pdf

Hassan, H., & Fakulti, B. (2011). *The criteria of language learning website.* Retrieved from http://eprints.utm.my/11971/1/The_Criteria_Of_Language_Learning_Website.pdf

Hernández, R., Fernández, C., & Baptista, P. (2006). Recolección y análisis de los datos cualitativos [Collection and analysis of qualitative data]. In R. Hernández, C. Fernández y P. Baptista (Eds.), *Metodología de la investigación* (pp.581-684). México: McGraw-Hill Interamericana.

Higueras, M. (2010). Criterios para la elaboración y selección de actividades comunicativas con internet [Criteria for the preparation and selection of communicative activities with Internet]. *MarcoELE* (10), 109-121. Retrieved from http://marcoele.com/descargas/expolingua_2002.higueras.pdf

Hita, G. (2004). La enseñanza comunicativa de idiomas en internet. Características de los materiales y propuesta didáctica [Communicative language teaching on the Internet. Characteristics of materials and didactic proposal]. *Red Electrónica de Didáctica del Español como Lengua Extranjera,* (2). Retrieved from http://www.mecd.gob.es/dctm/redele/Material-RedEle/Biblioteca/2004_BV_02/2004_BV_02_12Hita.pdf?documentId=0901e72b80e412c3

Hubbard, P. (1996). Elements of CALL methodology: Development, evaluation, and implementation. In M. Pennington (Ed.), *The power of CALL* (pp.15-33). Bolsover, TX: Athelstan.

Hubbard, P. (2003). A survey of unanswered questions in CALL. *Computer Assisted Language Learning, 16*(2-3), 141-154.

Hubbard, P. (2006). Evaluating CALL software. In L. Ducate & N. Arnold (Eds.), *Calling on CALL: From theory and research to new directions in foreign language teaching* (pp.1-26). San Marcos, Texas: CALICO.

Kartal, E. (2005). The Internet and autonomous language learning: A typology of suggested aids. *The Turkish Online Journal of Educational Technology, 4*(4), 54-58.

Kartal, E., & Uzun, L. (2010). The Internet, language learning, and international dialogue: Construction online foreign language learning websites. *Turkish Online Journal of Distance Education-TOJDE, 11*(2), 90-107.

Kelley, L. (1999). *Measurement made accessible: A research approach using qualitative, quantitative and quality improvement methods.* California: SAGE publications.

Knowles, J. (1992). Models for understanding pre-service and beginning teachers' biographies: Illustrations from case studies. In I. Goodson (Ed.), *Studying teachers' lives* (pp. 99-152). New York: Teachers College Press.

Lara, T. (2012). Alfabetizar en la cultura digital [Literacy in the digital culture]. In T. Lara, F. Zayas, N. Arrukero & E. Larequi (Eds.), *La competencia digital en el área de lengua* (pp.9-23). Barcelona: Octaedro.

Lázaro, O. & Fernández, J. (2000). Criterios de evaluación de materiales en la red: alumnos y usuarios de E/LE [Evaluation criteria of web-materials: SFL students and users]. *Cuadernos Cervantes, 28*. Retrieved from http://marcoele.com/descargas/expolingua1996_lozano-ruiz.pdf

Levy, M. & Stockwell, G. (2006). Evaluation. In M. Levy & G. Stockwell (Eds.), *CALL dimensions: Options and issues in Computer-Assisted Language Learning* (pp.40-83). Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.

Lion, C. (2012). *Desarrollo de competencias digitales para portales de la región* [Development of digital skills for portals in the region]. Retrieved from http://www.relpe.org/wp-content/uploads/2013/04/09-Desarrollo-de-CompetenciasDigitales-para-Portales-de-la-Regi%C3%B3n.pdf

Liu, M. (1994). Hypermedia assisted instruction and second language learning: A semantic-networked based approach. In M. Reed, J. Burton & M. Liu (Eds.), *Multimedia and megachange: New roles for educational computing* (pp. 293-312). Binghamton, United States: The Haworth Press.

Liu, G., Liu, Z., & Hwang, G. (2011). Developing multi-dimensional evaluation criteria for English learning websites with university students and professors. *Computers & Education, 56*(1), 65-79.

Lobin, H., & Rösler, D. (2012). Tutoring system and computers-assisted language learning (CALL). In A. Mehler, & L. Romary (Eds.), *Handbook of technical communication* (pp.571-589). Berlin, Germany: Mouton de Gruyter.

Lozano, G., & Ruiz Campillo, P. (2009). Criterios para el diseño y la evaluación de materiales comunicativos [Criteria for the design and evaluation of communicative materials]. *MarcoELE* (9), 127-155. Retrieved from http://marcoele.com/descargas/expolingua1996_lozano-ruiz.pdf

Luzón, J., & Soria, I. (1999). El enfoque comunicativo en la enseñanza de lenguas. Un desafío para los sistemas de enseñanza y aprendizaje abiertos y a distancia [The communicative approach to language teaching. A challenge for education systems and open and distance learning]. *Revista iberoamericana de educación a distancia, 2*(2), 63-92. Retrieved from http://dialnet.unirioja.es/servlet/articulo?codigo=318951

Ma, Q. (2008). Empirical CALL evaluation: The relationship between learning process and learning outcome. *CALICO Journal 26*(1), 108-122.

Magnúsdóttir, S. (2010). *Internet en la enseñanza del español como lengua extranjera: posibilidades y retos en su aplicación en el aula* (Undergraduate dissertation) [Internet in teaching Spanish as a foreign language: opportunities and challenges in its application in the classroom]. Islandia University, Reikiavik, Islandia. Retrieved from http://skemman.is/stream/get/1946/4202/12112/1/2_fixed.pdf

Mangenot, F. (1998). Classification des apports d'Internet à l´apprentissage des langues [Classification of the Internet contribution to language learning]. *ALSIC, 1*(2)*,* 133-146. Retrieved from http://hal.inria.fr/docs/00/00/16/95/PDF/alsic_n02-pra1.pdf

Mantilla, M. (n.d.). *Interactividad o repetición*. Trabajo Final del programa FONTE Formación Online de Tutores de Español de AulaDiez [Interactivity or repetition. Final work of the FONTE Online Spanish tutor training program of AulaDiez]. Retrieved from http://www.auladiez.com/didactica/FONTE-TrabajoFinalMargaritaMantillaDiaz.pdf

Mao, P., & Kung, S. (2001). ¿A lo virtual? ¿A lo real? Internet aplicada a la enseñanza de la gramática de E/LE [Virtual? Real? Internet applied to the SFL grammar teaching]. *XII congreso internacional de ASELE,* 567-575. Retrieved from http://cvc.cervantes.es/ensenanza/biblioteca_ele/asele/pdf/12/12_0567.pdf

Marquès, P. (1999). Criterios para la clasificación y evaluación de espacios web de interés comunicativo [Criteria for classification and evaluation of communicative web spaces]. *Educar* (25)*,* 95-111. Retrieved from http://www.raco.cat/index.php/educar/article/viewFile/20717/20557

Melero, P. (2004). De los programas nocional-funcionales a la enseñanza comunicativa [From notiofunctional programs to communicative teaching]. In J. Sánchez & I. Santos (Eds.), *Vademécum para la formación de profesores. Enseñar español como segunda lengua (L2)/ lengua extranjera (LE)* (pp. 689-714). Madrid: Sociedad general española de librería, S.A.

Mishan, F. (2013). Modes of delivery. In B. Tomlinson (Ed.). *Applied linguistics and material development* (pp. 287-301). London: Bloomsbury Linguistics.

Nomdedeu, A. (n.d). Actualización de los recursos del docente de ELE en Internet [The updating of SFL teachers resources on the Internet]. *redELE, (12),* 1-23. Retrieved from http://www.mecd.gob.es/dctm/redele/Material-RedE-le/Revista/2008_12/2008_redELE_12_06Nomdedeu.pdf?documentId=0901e72b80de14e5

Patton, M. (1990). *Qualitative evaluation and research methods*. Newbury Park: SAGE Publishers.

Plass, J. (1998). Design and evaluation of the user interface of foreign language multimedia software: A cognitive approach. *Language Learning & Technology, 2*(1), 35-45.

Reeder, K., Heift, T., Roche, J., Tabyanian, S., Schlickau, S., & Golz, P. (2004). Toward a theory of evaluation for second language learning media. In S. Fotos & C. Browne (Eds.), *New perspectives on CALL for second language classrooms* (pp.255–278). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Richards, J., & Rodgers, T. (1986). *Approaches and methods in language teaching.* Cambridge, UK: Cambridge University Press.

Robb, T., & Susser, B. (2000). The life and death of software. *CALICO Journal, 18*(1), 41-52.

Rodríguez, J. (2004). El uso de Internet en el aula de ELE [The Internet use in the SFL classroom]. *Revista electrónica de didáctica español lengua extranjera,* (2). Retrieved from http://www.mecd.gob.es/dctm/redele/Material-RedEle/Revista/2004_02/2004_redELE_2_14Rodriguez.pdf?documentId=0901e72b80e06a65

Rodríguez, E. (2012). *Guía para la construcción de indicadores de gestión* [Guide to building management indicators]. Retrieved from http://portal.dafp.gov.co/portal/pls/portal/formularios.retrive_publicaciones?no=1595

Rubio, D., Berg-Weger, M., & Tebb, S. (2003). Objectifying content validity: Conducting a content validity study in social work research. *Social Work Research, 27*(2), 94–104.

Seliger, H. & Shohamy, E. (1989). *Second language research methods*. Oxford, UK: Oxford University Press.

Squires, D., & McDougall, A. (1996). Software evaluation: A situated approach. *Journal of Computer Assisted Learning, 12*(3), 146-161.

Son, J.-B. (2005). Exploring and evaluating language learning Web sites. In J.-B. Son & S. O'Neill (Eds.), *Enhancing learning and teaching: Pedagogy, technology and* language (pp. 215-227). Flaxton, Australia: Post Pressed. Retrieved from https://eprints.usq.edu.au/820/1/Son_ch13_2005.pdf

Stoker, D., & Cooke, A. (1994). Evaluation of networked information sources. In A. H. Heal & J. W. Weiss (Eds.), *Information superhighway: The role of librarians, information scientist and intermediaries*. Proceedings of the 17th International Essen Symposium 24th - 27th October 1994. Retrieved from http://users.aber.ac.uk/das/texts/eval.htm

Susser, B. (2001). A defense of checklists for courseware evaluation. *ReCALL 13*(2), 261–276.

Tashakkori, A. & Teddlie, C. (2003). The past and future of mixed methods research: From data triangulation to mixed model design. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 671–702). Thousand Oaks, CA: Sage.

Tomlinson, B. (2011). Introduction: Principles and procedures of material development. In B. Tomlinson (Ed.), *Materials development in language teaching* (pp.1-26). Cambridge: Cambridge University Press.

Torat, B. (2000). *Computer-assisted language learning: An overview.* Thailand-Australia Science & Engineering Project (TASEAP). Retrieved from http://web.warwick.ac.uk/CELTE/tr/ovCALL/taseapCALL.pdf

Vela, J. (n.d.). *Criterios e indicadores para una evaluación en educación -educación para adultos-* [Evaluation criteria and indicators for education –adult education-]. Retrieved from http://www.redes-cepalcala.org/inspector/DOCUMENTOS%20Y%20LIBROS/EVALUACION/CRITERIOS-INDICADORES.doc

Warschauer, M., Shetzer, H., & Meloni, C. (2000). *Internet for English teaching*. Virginia, USA: Teachers of English to Speakers of Other Languages, Inc.

Yang, Y., & Chan, C. (2008). Comprehensive evaluation criteria for English learning websites using expert validity surveys. *Computers & Education* (51), 403-422. Retrieved from http://proj.ncku.edu.tw/research/articles/e/20071130/5.html

Appendix A

Sample of the Validity Survey Administered to the Language Expert (Checklist Proposal)

A. INSTRUCTIONS: This survey was designed with the purpose of validating each one of the criteria and descriptors that make up the checklist proposal.

Evaluation criterion: please match the descriptors with the appropriate criterion. If you considerer that the descriptor corresponds with the number of criterion indicated, mark an X in the “Yes” option. Otherwise, mark an X in the “No” option and write down within the blank space the criterion you consider is more appropriate, write down your reasons.

Evaluation descriptors: please indicate the degree of *Appropriateness, Representativeness, Importance and Clarity* of each of the following evaluation descriptors using the given 4-point scale. Note that in this survey, 4 is the highest degree and 1 is the lowest. We have included a space for you to leave your comments.

B. SURVEY

Evaluation criteria		Appropriateness				Representativeness				Importance				Clarity			
1. Ease of use 2. Reliability 3. Content Quality 4. Take advantage of the benefits of the environment 5. Autonomy 6. Language contextualization 7. Language skills integration 8. Interculturality 9. Interaction		Non-acceptance	Major revision is required	Minor revision is required	Good	Non-acceptance	Major revision is required	Minor revision is required	Good	Non-acceptance	Major revision is required	Minor revision is required	Good	Non-acceptance	Major revision is required	Minor revision is required	Good
		1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Descriptor 1 Allows free access to all its tools, resources and content.	☐ Yes, it belongs to criterion 1. ☐ No, it should belong to criterion number: _______ **Commentaries:**	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
		Commentaries:				**Commentaries:**				**Commentaries:**				**Commentaries:**			

Appendix B

Survey Administered to the Language Professional and One of the Participants of the Target Population (Checklist and Study Guide Proposal)

A. INSTRUCTIONS: This survey was designed with the aim of evaluating the quality of the proposed Study Guide as well as the Checklist model included within the first material.

SURVEY (Part 1): Please indicate the degree to which each of the following items *Impact, Feel at ease, Self-confidence, Usefulness-Relevance and Self-instruction* are favored within the Study Guide. Below each item, you will find a box for you to make any comments or suggestions.

IMPACT				
The Study Guide:	**1**	**2**	**3**	**4**
1. Has an appealing cover presentation.				
2. Its overall content arises your interest and motivation to know something new.				
3. Provides activities and content that encourage readers to think and reflect.				
Comments and/or suggestions:				

FEEL AT EASE				
The Study Guide:	**1**	**2**	**3**	**4**
4. Incorporates resources (e.g., exemplifications, illustrations, etc.) that help readers to increase their understanding on any topic.				
5. Has a "voice" that makes readers to feel comfortable (e.g., employs active voice, the content is accompanied with examples, etc.).				
6. Provides activities and content that involve the readers' active participation.				
Comments and/or suggestions:				

SELF-CONFIDENCE				
The Study Guide:	**1**	**2**	**3**	**4**
7. Makes readers feel the sequential and gradual progression of its contents.				
8. Offers activities that have a progressive level of difficulty.				
Comments and/or suggestions:				

USEFULNESS AND RELEVANCE				
The Study Guide:	**1**	**2**	**3**	**4**
9. Discloses inductively or deductively the learning objectives pursued when going through the content and the different proposed activities.				
10. Guides readers along the pages to make use of extra resources (e.g., glossary) in order to enhance their understanding.				
Comments and/or suggestions:				

SELF-INSTRUCTION				
The Study Guide:	**1**	**2**	**3**	**4**
11. Contains at least one activity in which readers are assigned with a responsibility (e.g., project) and have to make decisions on their own.				
Comments and/or suggestions:				

SURVEY (Part 2): Please indicate the degree to which each of the following items *Structure, Clarity of the instructions and Quality of the evaluation descriptors* are favored within the Checklist. Below each item, you will find a box for you to make any comments or suggestions.

STRUCTURE				
The Checklist:	**1**	**2**	**3**	**4**
12. Has been previously contextualized, so that evaluators know exactly what to look for when assessing any feature of the online material (i.e., within a Study Guide).				
13. Is divided into categories that allow it to have a well-organized and clear structure.				
14. Its evaluation system is of easy and clear use (e.g., weighting rating scale, type of questions, etc.).				
Comments and/or suggestions:				

CLARITY OF INSTRUCTIONS				
The Checklist:	**1**	**2**	**3**	**4**
15. Presents indications for use that guides the evaluator clearly.				
16. Provides the overall rating that the online material will reach.				
Comments and/or suggestions:				

QUALITY OF THE EVALUATION DESCRIPTORS				
Evaluation descriptors:	**1**	**2**	**3**	**4**
17. Do not have orthographic, typographic or grammatical errors.				
18. Are clearly written, so the evaluator can easily understand which aspects or features to evaluate within the online material.				
19. Incorporate a variety of examples in the cases when it is possible to identify more than one option to evaluate.				
20. Are organized in a logic and progressive fashion.				
Comments and/or suggestions:				

* The following part of the survey was only administered to the participant of the target population.

PERCEPTIONS ON THE TASK OF APPLYING THE CHECKLIST TO A LANGUAGE WEBSITE

21. How was your experience making use of the Checklist as an evaluation instrument to judge the quality and efficiency of a language website?

____

____.

22. What advantages and disadvantages did you encounter during this evaluation process?

____

____.

23. Which do you consider are the strengths of this Checklist and what aspects do you think should be improved?

____

____.

24. Will you use in a future the proposed Checklist model, yes or no, and why?

____

____

____.

Appendix C

Evaluation Language-Learning Websites Checklist

The checklist below consists of three main dimensions that encompass **technical** characteristics (*ease of use* and *reliability*), **contextual-pedagogical** characteristics (*content quality*) and **features related to the Communicative Approach principles** (*autonomy, language contextualization, language skills integration, interculturality, interaction* and *evaluation*). It is noteworthy that descriptors involving the last assessing dimension were written in relation to the possibilities provided by the website in terms fostering learners' low or high order thinking skills as well as boosting their communicative competence.

It is advisable to skim first this evaluation instrument before applying to a chosen language website. Additionally, the evaluator has to keep in mind that even though the checklist was mainly designed to provide insights on the Communicative Approach principles reflected on websites, it still allows teachers to glimpse its strengths in relation to other presented criteria.

Instructions: Mark with an "X" the column that best reflects the language website's quality in relation to the proposed evaluation criteria and descriptors.

TECHNICAL CHARACTERISTICS		
EASE OF USE		
The website:	**YES**	**NO**
1. Allows free access to all the tools, resources and content.		
2. Provides use specifications related to the hardware (e.g., processor, sound card, internet connection, etc.) and software requirements (e.g., Web browser such as Internet Explorer, Google Chrome, Mozilla, etc.).		
3. Includes a navigation guide/site map that ensures accessibility to the user and provides a general visual schema of the available contents.		
4. Includes frames that enable the permanent view of the index sections (e.g., menu, grammar, exercises, culture, etc.) and therefore, facilitates the transition between pages.		
5. Provides a clear and simple language, which allows a general understanding for users of different language levels.		
6. Uses a range of colors that do not fatigue or irritates the users' view and therefore, it is attractive and motivating to navigate.		
7. Has a balance between the textual and multimedia content.		
8. Respects the conventions of the virtual environment by underlying links in blue and presenting the information following the multimedia mesh.		
9. Has graphic consistency between the font sizes for titles, subtitles and text body, and icon buttons are always the same.		
Commentaries:		
RELIABILITY		
The website:	**YES**	**NO**
10. Is periodically updated (e.g., date of last update; links are still active, etc.).		

11. Provides information on the author(s) or the source of creation by means of links with labels such as *Who are we? About us, consultations, copyright or* simply *"us"*.		
12. Offers information on the teaching and/or learning theory on which it is based on.		
13. Is backed up by a person or a team of professionals in the language-teaching field.		
14. Does not contain spelling, typographical or grammatical errors.		
Commentaries:		
CONTEXTUAL PEDAGOGICAL CHARACTETISTICS		
CONTENT QUALITY		
The website:	**YES**	**NO**
15. Indicates the language level skills expected to attain when solving each of the given activities and exercises.		
16. Integrates a variety of contents, activities and resources.		
17. Includes the learning objectives pursued in the development of a particular activity or exercise.		
18. Contains short and comprehensible instructions that guide the development of the proposed activities and exercises.		
19. Sets out grammar in functional terms, that is from the perspective of how it creates and expresses meaning (e.g,. introducing oneself in order to work on the "verb to be" grammar topic).		
Commentaries:		
COMMUNICATIVE APPROACH-RELATED CHARACTERISTICS		
AUTONOMY		
The website allows learners to:	**YES**	**NO**
20. Find texts and resources of their choice by integrating hyperlinks that link words to input such as readings, videos, pictures, sounds, exercises, etc.		
21. Make different learning routes in and outside of its structure by providing hyperlinks and an internal searching box.		
22. Build their own learning pathways after taking a diagnostic and/or placement test.		
23. Monitor their learning process by solving language exercises or activities and clicking on the "check" option button.		
Commentaries:		
LANGUAGE CONTEXTUALIZATION		
The website allows learners to:	**YES**	**NO**
24. Inductively infer the uses of certain grammatical forms by providing input enhancement (e.g., capital letter, boldface, underlining, italics, etc.).		
25. Interpret within a text the meaning of unknown words or expressions by offering the support of linguistic resources such as dictionaries or clicking on buttons that display the definition in written or drawn form.		

26. Understand written and oral sentences by offering activities and exercises that lead them to reach a functional purpose within the language.		
27. Inductively contrast the use of linguistic forms of the different target-language variants by the exposure to authentic input in or outside its structure.		
28. Make predictions in relation to the content of a text by means of written or oral multimedia elements such as images, videos and audios.		
29. Use different groups of lexical units to solve activities or exercises that comprise a communicative purpose (e.g., planning a party).		
30. Rank the quality of the site and its contents (e.g., grammatical explanations, exercises, multimedia resources, etc.) by some of the following means: a mailbox of comments or recommendations, a feedback comments box, a "contact us" bottom, etc.		
Commentaries:		
LANGUAGE SKILLS INTEGRATION		
The website allows learners to:	**YES**	**NO**
31. Find oral or written texts according to their interests and communicative needs by redirecting to external sites (e.g., newspapers, magazines, shows, documentaries, live streaming radio or television, etc.).		
32. Recognize in oral or written texts the main ideas and details by presenting activities or exercises that favor the understanding of authentic materials (documentaries, podcasts, trailers, poems, stories, etc.).		
33. Identify prosodic features (e.g., intonation, accent, pauses, tone, etc.) coming from the communicative intention of characters in a video internally hosted or linked to other site.		
34. Recognize samples of authentic sounds through songs, dialogs of everyday life, audiobooks, etc. that provide a variety of communicative contexts.		
35. Self-monitoring their listening and reading comprehension skills by including activities that encompass authentic uses of the target language (e.g., dialogues, news reports, etc.).		
36. Check their oral comprehension by clicking on the transcription button for video or audio.		
37. Carry out oral and written activities that imply a communicative purpose by offering rich input (e.g., journals, videos, recordings, etc.) and encouraging input elaboration.		
Commentaries:		
INTERCULTURALITY		
The website allows learners to:	**YES**	**NO**
38. Identify the cultural traits of the different speaking regions of the target language through the inclusion of texts and resources that address sociocultural knowledge issues (e.g., daily life, conditions of life, values, beliefs, social conventions, ritual behavior, etc.) and therefore, prevents stereotyped attitudes.		
39. Recognize elements of non-verbal communication of the target culture in videos in which paralinguistic features can be easily evidenced (e.g., body language, gestures, facial expressions, tone and pitch of voice, etc.).		
40. Compare cultural traits of various speaking regions of the target language by integrating topics of cultural interest that have influenced people's lives (e.g., popular culture, politics, history, etc.).		

41. Contrast elements of their culture with those of the target language by providing videos, audios or readings that encompass linguistic variations (e.g., diatopic, diastratic and diaphasic).		
42. Interact with other users using synchronous (e.g., chat, instant messages) and/or asynchronous (e.g., email, forum, newsgroups, distribution lists, etc.) CMC tools hosted within the site or linked to other ones.		
43. Post their opinion on any topic and get to know others' by taking surveys and/or participating in a voting activity.		
44. Generate attitudes of openness and empathy towards the target culture by including texts, readings and/or videos that address issues such as immigration, political debates and the different standpoints, human rights, among others.		
45. Generate collaborative learning in real contexts of communication (e.g., forums, discussion boards, etc.).		
Commentaries:		
EVALUATION		
The website allows learners to:	**YES**	**NO**
46. Recognize their level of accomplishment in relation to the intended communicative objectives through the inclusion of any of these means: evaluation rubrics or phrases referring to what the student has been able to achieve when solving an activity or exercise.		
47. Identify in a particular exercise or activity their right answers and correct the errors by clicking on the auto-feedback button (e.g., delete the incorrect answers, indicate the percentage of hits or include an explanatory comment).		
48. Find and correct errors in oral and written comprehension activities that may affect communication, this by offering a feedback button where understanding is favored (e.g., automatically delete wrong answers that transgress the message).		
49. Deduct the possible answer(s) of an exercise by giving an explanatory hint.		
Commentaries:		
Total number=		

Once the grid has been filled, the evaluator can proceed to count out the number of **YES** entries related to the Communicative approach dimension, taking into account that it involves a total of 30 evaluation descriptors. The following chart displays the degree of qualification achieved by the website in regards to this specific language teaching approach:

Number of X entries in the "Yes" column (Communicative Approach)	**Degree of qualification**
Between 1 and 7 (Between 1% and 25%)	Poor (Not appropriate)
Between 8 and 15 (Between 26% and 50%)	Suitable (acceptable with reservations)
Between 16 and 22 (Between 51% and 75%)	Good (appropriate for use)
Between 23 and 30 (more than 75%)	Excellent (highly recommended)

For the overall rating of the language-learning website, the evaluator should count out the number of **X** entries on the **YES** column bearing in mind that the three evaluation dimensions (technical, contextual pedagogical characteristics and the ones related to the Communicative Approach principles) comprise a total of 49 evaluation descriptors. The following chart displays in detail the possible results:

Number of X entries in the "Yes" column (Overall evaluation)	**Degree of qualification**
Between 1 and 12 (Between 1% and 25%)	Poor (Not appropriate)
Between 13 and 24 (Between 26% and 50%)	Suitable (acceptable with reservations)
Between 25 and 36 (Between 51% and 75%)	Good (appropriate for use)
Between 37 and 49 (more than 75%)	Excellent (highly recommended)

Biographies

Mg. Sthephanny Moncada Linares is an English and research professor at the School of Education, La Gran Colombia University (Bogotá, Colombia). She holds a B.A. in Spanish, English and French from La Salle University and a M.A. in Applied Linguistics of Spanish as a Foreign Language from La Pontificia Universidad Javeriana. During the school year 2012-2013, she served as a Spanish Assistant as a Foreign Language (Amity Scholar) at University of Wisconsin-La Crosse (United States). Last year, 2015, she participated as a speaker in the Eighth edition of the International Conference ICT for foreign learning at Florence, Italy.

Mg. Andrea Carolina Díaz Romero is a high school English teacher at Cristo Rey Bogotá School. Carolina received a Bachelor of Arts Degree in Spanish, English and French in 2012 from La Salle University and a Master of Arts Degree in Applied Linguistics to the Spanish as a Foreign Language in 2015. Recently, she participated as a speaker in the Eighth edition of the International Conference ICT for foreign learning at Florence, Italy. She has worked as an English teacher for 5 years.

This page left blank intentionally

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Mor, D., Laks, H., & Hershkovitz, A. (2016). Computer skills training and readiness to work with computers. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 95-112. Retrieved from http://www.informingscience.org/Publications/3451

Computer Skills Training and Readiness to Work with Computers

Dalit Mor, Hagar Laks, and Arnon Hershkovitz
Tel Aviv University, Tel Aviv, Israel

dalitmor@mail.tau.ac.il, ehrenfeldh@mail.tau.ac.il, arnonhe@tauex.tau.ac.il

Abstract

In today's job market, computer skills are part of the prerequisites for many jobs. In this paper, we report on a study of readiness to work with computers (the dependent variable) among unemployed women (N=54) after participating in a unique, web-supported training focused on computer skills and empowerment. Overall, the level of participants' readiness to work with computers was much higher at the end of the course than it was at its beginning. During the analysis, we explored associations between this variable and variables from four categories: log-based (describing the online activity); computer literacy and experience; job-seeking motivation and practice; and training satisfaction. Only two variables were associated with the dependent variable: knowledge post-test duration and satisfaction with content. After building a prediction model for the dependent variable, another log-based variable was highlighted: total number of actions in the course website along the course. Overall, our analyses shed light on the predominance of log-based variables over variables from other categories. These findings might hint at the need of developing new assessment tools for learners and trainees that take into consideration human-computer interaction when measuring self-efficacy variables.

Keywords: Work readiness, working with computers, log-based variables, decision tree.

Introduction

Information and communication technology (ICT) is part of the everyday life in the 21st century, and the rapid development of ICT requires a completely new set of skills related to technological literacy (Voogt & Roblin, 2012). Many recent studies have explored the changes in employment demands as a result of developing technologies and have specifically mentioned the high demand for skilled workers (Acemoglu, 2002; Autor, Levy, & Murnane, 2003; Kim & Hwang, 2013; Srour, Taymaz, & Vivarelli, 2014). As Lin (2000) suggests, "computer literacy" might no longer be the right term to be used to describe the current profile of employees in today's job market, but rather fluency with information technology. This notion is also related to the concept of computer self-efficacy.

Editor: Gila Kurtz
Submitted: December 22, 2015; Revised: April 10, 2016; Accepted: April 16, 2016

Computer self-efficacy is defined as “an individual’s perceptions of his or her ability to use computers in the accomplishment of a task rather than reflecting simple component skills” (Compeau & Higgins, 1995). Many previous studies had examined individual differences in computer self-efficacy, suggesting various explaining measures, like attitudes towards computer usage and previous experience with computers (e.g., Hasan, 2003; Lam, Cho, & Qu, 2007; G. Torkzadeh & Van Dyke, 2002). Furthermore, positive associations between computer training and computer self-efficacy (or similar constructs) were found (e.g., Salanova, Grau, Cifre, & Llorens, 2000; R. Torkzadeh, Pflughoeft, & Hall, 1999). There is no wonder, therefore, that unemployed older workers express a desire to receive additional training on technology, preferably in a hands-on fashion (Lee, Czarja, & Sharit, 2008).

Therefore, training programs for employees often suggest both computer-related content and modules which aim on improving the participants’ self-efficacy concerning working in today’s job market; such a program is at the heart of the current study. While many previous studies have examined the efficiency of such programs in improving measures related to computer self-efficacy, the novelty of the current study is in examining the relationships between log-based (training-related) variables and a variable similar to computer self-efficacy.

Though very simple, these log-based measures outperform other variables—including such variables that were found in previous studies as good indicators to computer self-efficacy—in predicting the dependent variable, which measures perceptions of unemployed women’s readiness to work with computers. Exploring and understanding these relationships are the main purposes of this article.

Related Work

Computer Training and Readiness to Work with Computers

That computer training positively influences computer self-efficacy is not surprising (cf. Kher, Downey, & Monk, 2013; G. Torkzadeh & Koufteros, 1994; R. Torkzadeh et al., 1999), nor that this correlation might be mediated by type of training (Beas & Salanova, 2006; Gist, Schwoerer, & Rosen, 1989); however, changes in attitudes towards computers are not always demonstrated after a computer training (cf. G. Torkzadeh & Van Dyke, 2002). There is also a debate whether the training method has an effect on post-training computer self-efficacy (cf. Brown et al., 2005). That said, older adults’ computer self-efficacy is usually increased after computer training (cf. Laganá, Oliver, Ainsworth, & Edwards, 2011).

We focus on the case of people who work with computers. It was explicitly shown that time spent with computers is significantly positively correlated with attitudes toward working with computers (e.g., Orpen & Ferguson, 1991), hence the importance of well-designed training. This relationship might be mediated by attitudes toward computers: while for those workers showing high positive attitudes toward computers, their level of professional self-confidence rise as number of training hours increases, for those low in computer attitudes, professional self-confidence decreases with the increase in training hours (Beas & Salanova, 2006). When discussing employees who can choose whether to integrate computers into their practices or not (like often is the case with teachers), it was shown that computer training might indeed promote such an integration. (Colman, Gibson, Cotton, Howell-Moroney, & Stringer, 2015).

Of special interest to the current study are studies focusing on computer training immediately before, and related to, working with computers. One such study is that reported in Potosky (2002), in which SQL task-specific self-efficacy was explored after an SQL training for newly hired computer programmers. Interestingly, the measured self-efficacy was not found to be associated with training-related computer knowledge and experience (controlling for pre-training computer self-efficacy). Different findings were shown in McDonald (2004), demonstrating increase in self-efficacy for some trainees, however with an emphasis of the importance of the relationships between the trainees and the employer during the training. In addition, it was shown that self-efficacy beliefs regarding a given technology might be mediating between training for this system and the intention to adopt it (Wu, Wang, & Lin 2007).

Relationships between Interaction-related Variables and Learners' Perceptions

In recent years, relationships between variables related to student-computer interaction (either extracted from log files or measured in other methods) and learners' perceptions of various learning-related constructs have been studied. Some studies suggest weak relationship—or no relationship at all—between these two types of variables. For example, students' perceptions of their goal orientation while learning (whether they are oriented towards mastering or towards achievements) was not found to be related to a log-based measure of carelessness (that is, when a student knows the skill needed to solve a problem but does not demonstrate that skill); also, goal orientation, as well as perceptions of self-efficacy, were not found to associated with engagement with a computer-based learning system (Hershkovitz, Baker, Gobert, & Nakama, 2012; Hershkovitz, Baker, Gobert, Wixon, & Sao Pedro. 2013). Similarly, there were very weak relationships found between domain- and unit-level self-efficacy and hint-seeking and glossary use in mathematics tutor (Fancsali, Bernacki, Nokes-Malach, Yudelson, & Ritter, 2014). Possible explanations for the absence of such relationships are the differences in data granularity and/or the potentially strong effect of contextual variables.

Indeed, when granularity is similar for both types of measures or when they take into account contextual variables, some studies were able to find relationships between student-computer interaction and self-efficacy. Computer Science self-efficacy, for example, was found to be predictive of engagement (Grafsgaard, Wiggins, Boyer, Wiebe, & Lester, 2014); as both these measures were based on students' self-reports, this finding makes sense in light of the limitation mentioned above (in this case, both variables are at the same granularity, and engagement measuring is not biased by contextual variables). Similarly, when both types of variables are measured on a finer-grained level, relationships are found, and contextual variables (e.g., log-based and physiological) are predictive of self-efficacy (McQuiggan, Mott, & Lester, 2008). In our study, different granularities and different contexts of measurements are presented.

Methodology

Research Field

Data analyzed for this study was drawn from Appleseeds Academy's "Technological Empowerment for Unemployed Women" course (TEUW) and included log-based variables and survey-based variables (full details are following, under *Participants and Data*). During this course, unemployed women are taught basic computer applications (e.g., using Internet browsers and searching for information online, using basic MS Office applications, and sending emails) and best job-seeking practices. In addition, the participants take part in an empowerment workshop, in order to enhance their chances of finding a job in today's computer-enriched market. A typical course includes 16 meetings (4.5-hour long each) taken within one month, of which 13 focus on technological topics and are led by Appleseeds Academy instructors, and 3 are focused on empowerment and are led by expert advisers.

The course is accompanied by a Moodle website, holding all of the materials used during the meetings and extra materials for self-learning. The website also includes a discussion forum, a message board, and a module to create an online glossary by the participants.

Appleseeds Academy

Established in 2000 as a business sector initiative, Appleseeds Academy aims to bridge social and economic gaps in the Israeli society by diminishing the country's digital divide. As Israel's hi-tech industry booms and those in weaker communities get left behind, Appleseeds Academy partners with businesses, government, and other NGOs to provide professional training, educational programming and hands-on personal development and social intervention opportunities for underserved populations in Israel. The TEUW course is organized in cooperation with the Israeli Employment Service, WIZO (Women's International Zionist Organization, a volunteer organization dedicated to social welfare of Jewish women in Israel and worldwide), and Microsoft Israel.

Participants and Data

Overall, we collected data of 54 participants, all women of ages 25-65, who took the TEUW course during February-March 2014. Participants were drawn from groups located in different areas of Israel, including both big cities and small towns. Data were collected via different tools (for a full list of the variables, see *Research Variables*).

Knowledge pre/post-test

The knowledge pre-test was administered online early during the first meeting of the course; the post-test at the end of the last meeting of the course.

Pre/post survey of computer use and attitudes towards computers

These surveys are measuring attitudes towards computers, previous experience with computers, and employment self-efficacy. They also collect some demographics variables (e.g., age, religion, place of birth) and employment-related variables (e.g., previous occupation, unemployment period). The post survey included items asking for feedback about the training, specifically satisfaction with various aspects of it. These pre/post surveys were administered immediately before the knowledge pre/post-tests, respectively, using the same system.

Log files

Moodle log files documented a total of 5,159 actions, widely ranging between 3-575 actions for participant, with an average of 96 actions per participant, a median of 76, and a high variance (SD=102). The frequency of actions per participant is exponential-like – that is, most participants present low activity, while only a few are very active – which is a very typical pattern for web access; it is referred to as the "participation inequality" (Nielsen, 2006) and was shown in many different educational contexts (e.g., Fournier, Kop, & Sitlia, 2011; Hershkovitz & Nachmias, 2010).

Research Variables

The dependent variable is Post-training Employment Readiness High/Low. It is binary (1/0 for high/low readiness), based on a median split of the average of five employment-efficacy items in the post-survey, each of which was scored on a 5-point Likert scale. The original items are:

- I feel confident to present my skills and strengths
- I feel confident to go to job interviews
- I believe in my ability to acquire knowledge independently
- I can use a computer independently to learn new areas
- I feel I can get a job that matches my abilities and skills

We chose to convert the Post-training Employment Readiness into a binary variable as for the relatively small size of population and due to its non-normal frequency (see previous section).

Over all, we have 17 independent variables from four categories:

Log-based variables (3 variables)

From Moodle log files, we computed for each participant the following:

- *Total Number of Actions* (Moodle only)
- *Knowledge Pre/Post-Test Length* (in minutes, time-difference between entrance to the test and hitting the "Finish" button)

Computer literacy, experience (4 variables)

- *Knowledge Pre/Post-Test Score* – each is the percentage of correct answers from the pre/post knowledge test
- *Computer Pre/Post-Use* – each is an average of six items from the pre/post survey referring to computer applications use (rated on a 5-point Likert scale)

Job-seeking motivation and practice (6 variables)

These variables are based on relevant items (scored on a 5-point Likert scale) from the pre/post survey. The variables are:

- *Pre-training Employment Readiness* is calculated the same way as the dependent variable, based on the pre survey (without a median split)
- *Motivation towards the Training* (1 item)
- *Pre/Post Job-seeking Activeness* (6 items, e.g., "I use family/friends during my job seeking", "I send out my CV via job search websites")
- *Pre/Post Beliefs in Finding Suitable Job* (1 item)

Training satisfaction (4 variables)

These variables are based on relevant items from the post survey, asking for feedback about the training (each items was scored on a 5-point Likert scale). The variables are:

- *Satisfaction with Content* (5 items)
- *Satisfaction with Instructor* (7 items)
- *Satisfaction with Empowerment Workshop* (9 items)
- *Satisfaction with Final Project* (3 items)

Results

Pre/Post-Training Employment Readiness

As a first step, we explored some statistics of the *Pre/Post-training Employment Readiness* variables (see Table 1). Overall, the mean *Post* (M=4.45, SD=0.61) is meaningfully and statistically significantly higher than the mean *Pre* (M=3.66, SD=0.88), with t(53)=5.33, at $p<0.001$ (a paired-sample t-test was used).

Table 1. Descriptive statistics for the *Pre/Post-Training Employment Readiness* variables

VARIABLE	MEAN	SD	SKEWNESS
Pre	3.66	0.88	-0.65
Post	4.45	0.61	-1.10

However, it is interesting to explore the relationships between these two variables more deeply. As may be understood from the very different skewness values (see Table 1), the *Pre/Post* variables are distributed differently; while *Pre-Training Employment Readiness* can be seen as skewed from normality, *Post-Training Employment Readiness* is clearly not normal (see Figure 1); the *Post* variable might demonstrate a ceiling effect. Testing the *Pre/Post* variables for normality, using one-sample Kolmogorov-Smirnov test, results with both being non-normal, howev-

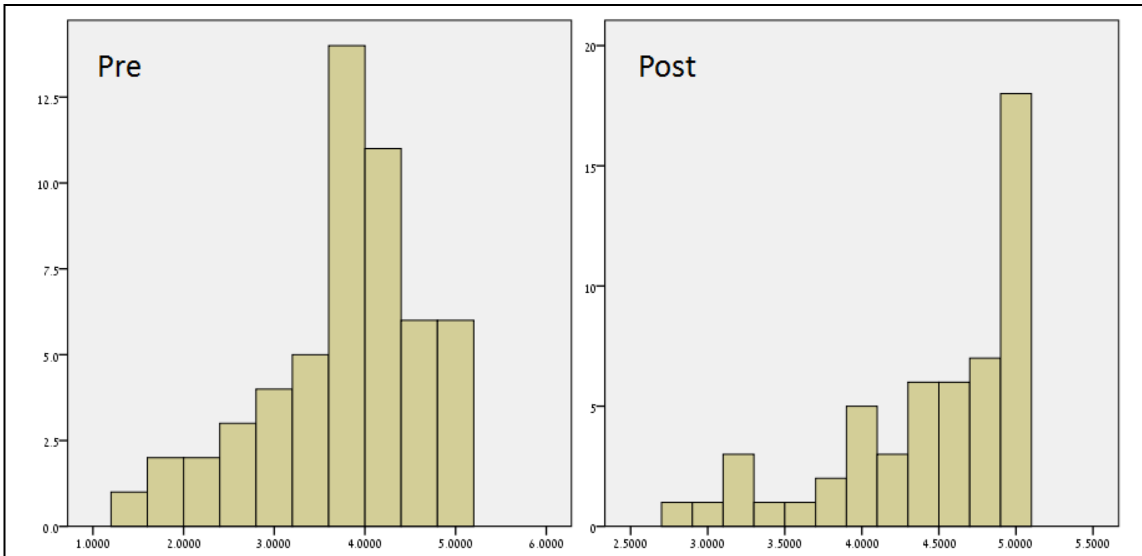


Figure 1. *Pre/Post-Training Employment Readiness* distribution (note the different scales on both axes)

er with different values of 0.13 and 0.05, respectively (both at $p<0.05$). Therefore, it is of no surprise that these two variables are not statistically significantly correlated ($r=-0.04$, at $p=0.8$).

Overall, it seems that the course had dramatically increased the level of participants' readiness to work with computers, and that the *Post-training Employment Readiness* might even demonstrate a ceiling effect.

Direct Relationship between the Dependent and the Independent Variables

Before highlighting some interesting relationships between *Post-training Employment Readiness High/Low* and the independent variables, it is important to comment about the variable *Post-training Employment Readiness* (that is, before the median split). It was found that no independent variable was correlated with this pre-median split variable. This surprising finding might be explained by the non-normality of the continuous version of the dependent variable (see previous section); hence, we will focus our analyses on the binary version of it.

The following analyses are based on independent sample t-test values, comparing the independent variable means between the two groups formed by the dependent variable values (high/low employment readiness). Unless otherwise stated, *df=52*. T-test values are presented in absolute value.

Log-based variables

When comparing mean values of the three log-based variables, only one shows significant difference between the high and the low employment-ready participants; this variable is *Knowledge Post-Test Length* (see Table 2 for the full comparison results). The average of the low employment-ready group (~37 minutes) is more that 60% higher than the average of the high employment-ready group (~23 minutes); this difference is statistically significant, with $t(24.8)=2.4$, at $p<0.05$. As Levene's test for equality of variances was significant (with $F=11.2$, at $p<0.01$), we did not assume equal variances.

Table 2. Comparing means of log-based variables by high/low employment-readiness

VARIABLE	MEAN (SD) FOR HIGH (N=31)	MEAN (SD) FOR LOW (N=23)	t
Total Number of Actions	104.0 (122.7)	84.2 (65.0)	0.7
Knowledge Pre-Test Length [sec]	881.6 (310.9)	904.5 (368.3)	0.2
Knowledge Post-Test Length [sec]	1365.2 (528.2)	2206.0 (1818.8)	2.4[*,a]

[*] $p<0.05$, [a] $df=24.8$, Levene's test for equality of variances was significant, hence equal variances were not assumed

This finding of relationship between employment-efficacy and log-based measures of online activity is in line with the more general established relationship between self-efficacy beliefs and persistence/engagement (which are often measured by time on task or number of items completed) (cf. Multon, Brown, & Lent, 1991; Ouweneel, Schaufeli, & Le Blanc, 2013). It is possible that the participants with high employment-efficacy were more engaged and/or more persistent during the post-test than the participants low on employment-efficacy, which helped the former finish it faster than the latter. One might think that these differences in post-test duration imply on differences in actual knowledge, but, as will be shown in the next sub-section, no differences were found between the two groups with regards to computer knowledge or experience.

Interestingly, the *Knowledge Pre/Post-Test Length* are not statistically significantly correlated with each other (r=-0.08, at p-0.56); also, neither of them is significantly correlated with *Total Number of Actions*. This might hint on *Knowledge Post-Test Length* depicting some constructs that are different from those depicted in *Knowledge Pre-Test Length.*

Computer literacy, experience variables

Comparing mean values of the four variables related to computer literacy and experience, none shows significant difference between the high and the low employment-ready groups (see Table 3). This is surprising, as previous studies have shown relationships between similar variables.

For example, Potosky (2002) had shown that post-training software efficacy (after a software training) was correlated with both computer knowledge and training performance (which may refer to our *Knowledge Pre/Post-Test Score)*; and, generally, computer self-efficacy has been shown to be related to prior experience with computers (e.g., Cassidi & Echaus, 2002; Rex & Roth, 1998; Topkaya, 2010). This is further discussed in the *Conclusions and Discussion* section.

Table 3. Comparing means of computer literacy and experience variables by high/low employment-readiness

VARIABLE	MEAN (SD) FOR HIGH (N=31)	MEAN (SD) FOR LOW (N=23)	t
Knowledge Pre-Test Score	0.50 (0.13)	0.54 (0.13)	1.0
Knowledge Post-Test Score	0.80 (0.10)	0.83 (0.08)	1.2
Computer Pre-Use	3.47 (0.43)	3.52 (0.41)	0.4
Computer Post-Use	3.82 (0.34)	3.71 (0.46)	1.1

Analyzing correlations of pairs of these variables results with some interesting insights. First, *Knowledge Pre-Test Score* is significantly correlated with *Computer Pre-Use* (r=0.36, at $p<0.05$). This is of no surprise, as the relationship between prior computer experience and performance (as well as with computer self-efficacy) has been long established (cf. Marakas, Yi, & Johnson, 1998). However, the lack of correlation between *Knowledge Post-Test Score* and neither *Computer Pre-Use* (r=0.23, at p=0.09) nor *Computer Post-Use* (r=0.09, at p=0.52) is surprising.

A paired-sampled t-test reveals that across the whole population (N=54), *Knowledge Pre/Post-Test Score* means are significantly different from each other (M=0.52, SD=0.13, and M=0.81, SD=0.09, respectively), with t(53)=15.3, at p<0.001; the same goes for the difference between *Pre/Post Computer Use* means (M=3.49, SD=0.43, and M=3.77, SD=0.39, respectively), with t(53)=3.9, at p<0.001. However, while *Knowledge Post-Test Score* is over 50% higher than *Knowledge Pre-Test Score*, the increase between *Computer Pre/Post-Use* is only minor. It is only natural that the latter is much less prominent than the former, as one-month timeframe (the length of the course) is long enough to accumulate knowledge, while it is too short for changing computer use habits. Indeed, across the whole population, *Pre/Post Computer Use* means are not significantly correlated (r=0.20, p=0.15), which might indicate on the irregular computer use changes adopted by the participants.

Therefore, we suggest that the reasons for *Pre Computer Use* and *Computer Post-Use* not being correlated with *Knowledge Post-Test Score* are different; for the former, the explanation probably lies in the dramatic increase in knowledge, which is incomparable to the increase in computer use, and for the latter it might be the irregular patterns of computer use adopted by the participants which changed the dynamics between computer use and knowledge.

Job-seeking motivation and practice variables

Comparing mean values of the six variables related to computer literacy and experience, none shows significant difference between the high and the low employment-ready groups (see Table 4).

Table 4. Comparing means of job-seeking motivation and practice variables by high/low employment-readiness

VARIABLE	MEAN (SD) FOR HIGH (N=31)	MEAN (SD) FOR LOW (N=23)	t
Pre-training Employment Readiness	3.59 (0.96)	3.75 (0.77)	0.64
Motivation towards the Training	4.84 (0.52)	4.83 (0.49)	0.09
Pre Job-seeking Activeness	0.32 (0.31)	0.69 (0.33)	0.80
Post Job-seeking Activeness	0.82 (0.29)	0.83 (0.26)	0.12
Pre Beliefs in Finding Suitable Job	4.61 (0.92)	4.57 (0.90)	0.19
Post Beliefs in Finding Suitable Job	4.58 (1.12)	4.39 (1.27)	0.58

Across the whole population (N=54), *Post Job-seeking Activeness* is higher than *Pre Job-seeking Activeness*, with means of 0.65 (SD=0.32) and 0.82 (SD=0.27), respectively. These differences are statistically significant, with t(53)=3.27 (paired-sample t-test), at p<0.01. This is of no surprise, as one of the goals of the course was to empower the participants to an active job search.

Therefore, the non-significant difference between the means of *Pre/Post Beliefs in Finding Suitable Job* (4.59, SD=0.9, and 4.50, SD=1.18, respectively) is surprising, with t(53)=0.43, at p=0.67. One should expect that after such an empowerment, and after gaining relevant knowledge, attitudes towards a successful job-seeking would positively change. This might be a result of a ceiling effect in the *Pre* variable, or maybe a dissatisfaction with the Israeli job market.

Training satisfaction variables

Comparing mean values of the five variables related to computer literacy and experience, only one shows significant difference between the high and the low employment-ready groups, *Satisfaction with Content* (see Table 5).

As previous works showed, satisfaction with training is correlated with post-training self-efficacy and ability to cope (e.g., Saks, 1995).

Table 5. Comparing means of training satisfaction variables by high/low employment-readiness

VARIABLE	MEAN (SD) FOR HIGH (N=31)	MEAN (SD) FOR LOW (N=23)	t
Satisfaction with Content	4.59 (0.42)	4.23 (0.68)	2.39[*,a]
Satisfaction with Instructor	4.77 (0.49)	4.83 (0.42)	0.41
Satisfaction with Empowerment Workshop	4.42 (0.66)	4.57 (0.44)	0.92
Satisfaction with Final Project	4.57 (0.53)	4.71 (0.53)	0.96

[*] $p<0.05$

[a] df=34.3, Levene's test for equality of variances was significant, hence equal variances were not assumed

Summary of relationships

While exploring direct relationships between the dependent variable and the independent variables – using independent-sample t-tests – we have found only two significant relationships. These relationships were found to log-based and satisfaction-related variables:

- Participants with high *Post-training Employment Readiness* values took the knowledge post-test (*Knowledge Post-Test Length*) much quicker than those with low values (~23 minutes, compared with ~37 minutes);
- Participants with high *Post-training Employment Readiness* values were satisfied with the course content (*Satisfaction with Content*) more than those with low values (4.59 on a 5-point Likert scale, compared with 4.23).

We now move on to exploring more complicated relationships, using a prediction model.

Predicting the Dependent Variable

We now use a decision tree model in order to explore more complex relationships between the dependent (predicted) variable and the independent variables (the predictors). We choose a decision tree model as for its interpretability.

We developed the decision tree model using RapidMiner Studio (Mierswa, Wurst, Klinkenberg, Scholz, & Euler, 2006), with a manual forward feature selection. This process starts with building and assessing single-feature models for each of the variables, selecting the best model. Then, each of the remaining variables (not already in the model) is tested for model improvement (now, as a two-feature model). The process goes on until no improvement is gained. Prediction goodness was tested using kappa, and was validated using leave-one-out cross-validation (LOOCV).

Of the single-feature models, only one performed better than chance. This is the model built with *Knowledge Post-Test Length*, which resulted with a LOOCV kappa of 0.334. This is not surprising as for the lack of relationships between the dependent variable and all but two of the independent variables, one of which was *Knowledge Post-Test Length*. Recall that the other variable that was found related to the dependent variable was *Satisfaction with Content*, and indeed this was the second variable to be added to the model.

The final model has a LOOCV kappa of 0.524. The full tree is presented in Figure 2; its corresponding confusion matrix is presented in Table 6. Overall, three variables entered the best decision tree in the following order:

1. *Knowledge Post-Test Length*
2. *Satisfaction with Content*
3. *Total Number of Actions*

The tree size is 16, its height is 7, and it has 9 leaves. The paths to the leaves define the groups that were predicted as high/low in post-training employment readiness.

```
Post Test Length > 2911: L {L=7, H=0}
Post Test Length ≤ 2911
| Satisfaction with Content > 3.7
| | Num. of Actions > 14
| | | Num. of Actions > 19
| | | | Post Test Length > 1008
| | | | | Post Test Length > 1299
| | | | | | Post Test Length > 1596
| | | | | | | Num. of Actions > 61: H {L=1, H=7}
| | | | | | | Num. of Actions ≤ 61: L {L=2, H=1}
| | | | | | Post Test Length ≤ 1596: H {L=0, H=8}
| | | | | Post Test Length ≤ 1299: L {L=7, H=1}
| | | | Post Test Length ≤ 1008: H {L=0, H=6}
| | | Num. of Actions ≤ 19: L {L=2, H=0}
| | Num. of Actions ≤ 14: H {L=0, H=8}
| Satisfaction with Content ≤ 3.7: L {L=4, H=0}
```

Figure 2. Best decision tree prediction model for *Post-training Employment Readiness* (L=Low, H=High). Variable names are shortened for having a better presentation; prediction is marked in bold red letters; true values distribution in each leaf are brought in curly brackets

Characterization of participants predicted as having high post-training employment readiness

We now follow the corresponding four paths to the "High" leaves (see Figure 2), in order to characterize participants predicted as having high post-training employment readiness.

Participants who took the knowledge post-test in more than 49 minutes or that were satisfied with the course content at a level of 3.7 or less (out of 5) are predicted as having low post-training employment readiness. Of the rest of the participants, either of the following characterizations refer to the "High" group:

- Performed at most 14 actions on the course website throughout the course
- Performed more than 19 actions on the course website throughout the course
  AND
  took the knowledge post-test in 17 minutes or less
- Took the knowledge post-test in between 22-27 minutes
- Took the knowledge post-test in 27 minutes or more
  AND
  Performed more than 61 actions on the course website throughout the course

Table 6. Confusion matrix for the best prediction model of Post-training Employment Readiness High/Low

		ACTUAL		PRECISION
		LOW	HIGH	
PREDICTION	LOW	13	2	86.7%
	HIGH	10	29	74.4%
RECALL		56.5 %	93.5%	

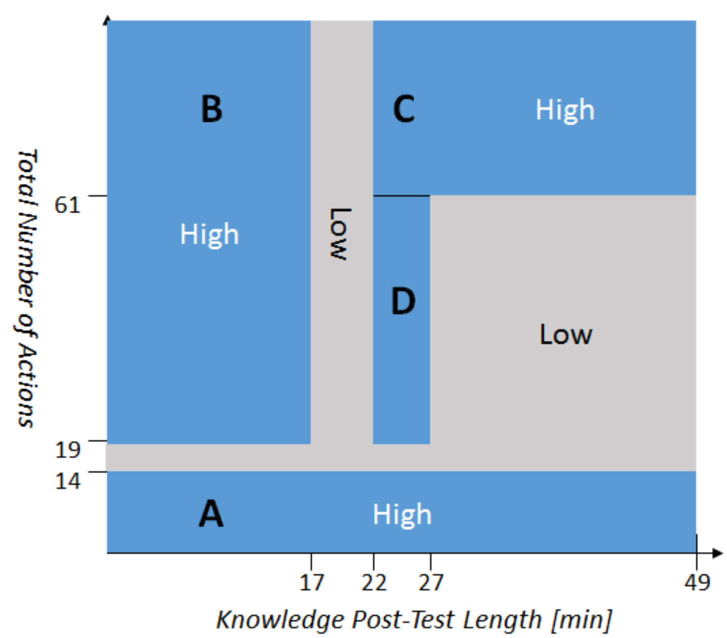


Figure 3. Prediction of *Post-training Employment Readiness* as an interaction between *Knowledge Post-Test Length* and *Total Number of Action*; this chart refers only to the sub-group who took the knowledge post-test in 49 minutes or less and were satisfied with the course content at a level greater than 3.7 (out of 5). The "High" regions are marked with letters (A-D) for ease of reference in the text

For having a better understanding of the interaction between *Knowledge Post-Test Length* and *Total Number of Action* and its effect of the dependent variable prediction, we present an illustration of the High/Low predictions of these two independent variables, see Figure 3. This chart refers only to the group of participants who took the knowledge post-test in no more than 49 minutes and were satisfied with the course content at a level greater than 3.7.

From the illustration, we can easily observe the group of participants who took the knowledge post-test in relatively a short time and were active online to some degree (group B). That this group is predicted as “High” in post-training employment readiness is only reasonable. Another easily explained group is D, which gathers participants with both values in the mid-range.

Group C holds participants who took the knowledge post-test in relatively a long time and were relatively highly active online. These might be participants who—despite being relatively slow in the exam—were truly engaged with the course materials, hence eventually feeling ready for the job market.

Group A holds participants with relatively low online activity, and they were predicted to have high post-training employment readiness no matter the length they took the knowledge post-test. This finding is surprising and why it was predicted as “High” is yet to be explored.

Conclusions and Discussion

In this study, we explored relationships between post-training readiness to work with computers and variables of different categories: log-based, computer literacy and experience, job-seeking motivation and practice, and training satisfaction. This was done in the context of unemployed women taking a computer training in order to improve their readiness to work with computers.

Of the many interesting findings reported here, we would now elaborate on a few. First and foremost, the absence of relationships between the independent variable, *Post-training Readiness to Work with Computers*, and all but two of the variables, namely, *Knowledge Post-Test Length* (that is, the duration it took the participants to take the knowledge post-test) and *Satisfaction with Content* (of the training). Of these two, the difference in post-test duration between participants with high and low values of readiness to work with computers is striking. This variable was found prominent while constructing a prediction model of the independent variable with a nice LOOCV kappa of 0.334, a model that was improved—besides by the only other variable that was found associated with the independent variable—with another log-based feature, *Total Number of Actions* (within the course site); the final model shows an impressive LOOCV kappa of 0.524.

The prominence of these rather simple log-based variables in predicting readiness to work with computers is emphasized when recalling that there were no differences between the high/low employment-efficacy groups concerning computer knowledge or experience. This means that the differences in the time it took the participants to finish the post-test might be indicative of something other than knowledge. We hypothesize that the post-test time-on-task depicts some other constructs, either the mere ability to work with computers (as the tests were taken online) or some other personal attributes. This is a possible future direction, motivated by the promises of log-based prediction being efficient and cheap when compared to other alternatives.

A second interesting finding (already mentioned above) is the lack of relationships between *Post-training Readiness to Work with Computers* and the computer literacy and knowledge variables, namely *Knowledge Post-Test Score* and *Computer Post-Use*, which seem counterintuitive. In the context of the current study, the lack of relationships might be a result of the trained content itself; it was shown already that while training in advanced computer tasks (like programming) is indeed related to higher computer self-efficacy, training in simple tasks (like word processing or spreadsheets) have only little effect on computer self-efficacy (Hasan, 2003).

In the training researched in this study, most of the content was indeed related to simple computer tasks, which might explain the lack of relationships to *Post-training Employment-readiness*. Another possible explanation is given in Burger and Blignaut (2004), who had found that both attitudes toward computers decreased after a five-month computer literacy course; the authors suggest that the course might have made the students realize how little they actually knew about computers. A positive change in attitudes toward computers might have occurred were a longer course given. An important implication of this finding relates to the duration of computer literacy programs. In order to be effective, these should be planned based on participants' previous experience and expectations.

Finally, the lack of relationships between the vast majority of the independent variables and the dependent variable make us think of either examining other types of variables or applying more advanced analyses. It might be that second- or higher-order effects have not yet been fully revealed. An example for such effect is the appearance of *Total Number of Actions* in the decision tree model. Important to notice, this study is unique in both population and the purpose of the computer training involved, so contradictory findings to previous findings should be examined with this in mind.

Implications of this study may be thought of in a few levels. Understanding of the factors related to readiness to work with computers is important with regards to numerous populations, mainly those low in employability. As the job-market keeps changing, and as more and more jobs become computer-enriched, computer training for such populations are crucial not only for them, but also for the society at large (Kalef, Barrera, & Heymann, 2014; Ktoridou & Eteokleous-Grigoriou, 2011). Our findings concerning one such program highlight the need of more research for exploring the factors that affect post-training readiness to work with computers, in order to plan similar programs accordingly.

On another level, our findings shed light on the strong associations between log-based variables and measures related to computer self-efficacy. Two of the three features in the final prediction model are log-based. Obviously, the use of log-based variables is far more efficient than any other variable, hence our study suggests this direction as promising in exploring the complexity of constructs related to either computer or employment self-efficacy. Having a further understanding of the role of these variables in predicting self-efficacy may assist in improving its prediction and might lead to the ability to detect critical issues in real-time.

The relationships found between log-based variables and the dependent variable, which measures readiness to work with computers, can be examined through recent trends in learners' assessment. In recent years, it has been suggested – and empirically shown – that other measures rather than post-learning tests are to be considered while evaluating learners' success. Of the suggested measures are log-based variables (e.g., Baker, Hershkovitz, Rossi, Goldstein, & Gowda, 2013; Gobert, Sao Pedro, Raziuddin, & Baker, 2013; Iglesias-Pradas, Ruiz-de-Azcárate, & Agudo-Peregrina, 2014; Ventura & Shute, 2013). Along this line is also a recent study showing the power of measuring engagement with a computer-based learning environment during secondary school in predicting college enrollment (San Pedro, Baker, Heffernan, & Ocumpaugh, 2015). This stream of research might enable a better understanding of adult education and its efficiency and might add on the currently, coarse-grained measures of such programs (cf. Badescu, Garrouste & Loi, 2013).

This study is not without limitations. One limitation is the definition of the dependent variable, namely, readiness to work with computers. This construct is somewhat a combination of readiness to work and attitudes toward computers. As this was the first exploration of the relationships of this construct with log-based variables, we decided to test it as one measure. This decision might not be unjustified, as for many jobs in today's job-market one can barely distinguish between working with computers and working per se. Specifically, this might be the case in the population and training discussed in this study, as the unemployed women who took the training were taught computer skills while being motivated to work – all in the purpose of being prepared to work in a computer-enriched environment. As was previously shown, attitudes toward computers and attitudes toward working with computers might not be significantly different from each other (Jawahar & Elango, 1998). Still, one obvious future direction would be to test this construct for possible different components, like general self-efficacy, computer self-efficacy, and professional self-confidence, maybe even to distinguish between general computer self-efficacy and different software self-efficacy measures (cf. Argawal, Sambamurthy, & Stair, 2000; Beas & Salanova, 2006; G. Torkzadeh & Koufteros, 1994).

Another limitation is the relatively small population size. Conducted as an exploratory phase, N=54 might be considered as a nice population, however for validating our results a larger population is needed. Focusing on more complex log-based features, we plan on keep studying the phenomena discussed here with a larger population and with improved research tools.

References

Acemoglu, D. (2002). Technical change, inequality, and the labor market. *Journal of Economic Literature 40*(1), 7–72.

Argawal, R., Sambamurthy, V., & Stair, R.M. (2000). Research report: The evolving relationship between general and specific computer self-efficacy – An empirical assessment. *Information System Research*, *11*(4), 418-430.

Autor, D., Levy, F., & Murnane, R. (2003). The skill content of recent technological change: An empirical exploration. *The Quarterly Journal of Economics, 118*(4), 1279–1333.

Badescu, M., Garrouste, C., & Loi, M. (2013). The distribution of adult training among European unemployed: Evidence from recent surveys. *International Journal of Continuing Engineering Education and Life-Long Learning, 5*(2), 103-120.

Baker, R. S. J. d., Hershkovitz, A., Rossi, L. M., Goldstein, A. B., & Gowda, S. M. (2013). Predicting robust learning with the visual form of the moment-by-moment learning curve. *Journal of the Learning Sciences, 22*(4), 639-666.

Beas, M. I., & Salanova, M. (2006). Self-efficacy beliefs, computer training and psychological well-being among information and communication technology workers. *Computers in Human Behavior*, 22(6), 1043-1058.

Brown, L., Johnson, T., O'Connor, D., Khalil, M., Huang, X., Lee, Y., & Lee, M. (2005). Effect of training method on performance and computer-self efficacy. *Proceedings of the Annual Convention of the Association for Educational Communications and Technology (October 18-22, Orlando, FL)*, 69-75.

Burger, A., & Blignaut, P. (2004). A computer literacy course may initially be detrimental to students' attitudes towards computers. *Proceedings of the 2004 annual research conference of the South African institute of computer scientists and information technologists on IT research in developing countries (October 4-6, Stellenbosch, Western Cape, South Africa)*, 10-14.

Cassidi, S., & Echaus, P. (2002). Developing the computer user self-efficacy (CUSE) scale: Investigating the relationship between computer self-efficacy, gender and experience with computers. *Journal of Educational Computing Research*, *26*(2), 133-153.

Colman, L. O., Gibson, P., Cotter, S. R., Howell-Moroney, M., & Stringer, K. (2015). Integrating computing across the curriculum: The impact of internal barriers and training intensity on computer integration in the elementary school classroom. *Journal of Educational Computing Research, 54*(2), 275-294.

Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, *19*(2), 189-211.

Fancsali, S. E., Bernacki, M. L., Nokes-Malach, T. J., Yudelson, M., & Ritter, S. (2014). Goal orientation, self-efficacy, and "online measures" in intelligent tutoring systems. *The 36th Annual Meeting of the Cognitive Science Society (July 23-26, Quebec City, QC)*.

Fournier, H., Kop, R., & Sitlia, H. (2011). The value of learning analytics to networked learning on a personal learning environment. *Proceedings of the 1st International Conference on Learning Analytics and Knowledge*, 104-109, ACM New York, NY.

Gist, M. E., Schwoerer, C., & Rosen, B. (1989). Effects of alternative training methods on self-efficacy and performance in computer software training. *Journal of Applied Psychology*, *74*(6), 884-891.

Gobert, J. D., Sao Pedro, M., Raziuddin, J., & Baker, R. (2013). From log files to assessment metrics: Measuring students' science inquiry skills using educational data mining. *Journal of the Learning Sciences, 22*(4), 521-563.

Grafsgaard, J. F., Wiggins, J. B., Boyer, K. E., Wiebe, E. N., & Lester, J. C. (2014). Predicting learning and affect from multimodal data streams in task-oriented tutorial dialogue. *The 7th International Conference on Educational Data Mining* (July 4-7, London, UK).

Hasan, B. (2003). The influence of specific computer experiences on computer self-efficacy beliefs. *Computers in Human Behavior*, *19*(4), 443-450.

Hershkovitz, A., Baker, R. S. J. d., Gobert, J., & Nakama, A. (2012). A data-driven path model of student attributes, affect, and engagement in a computer-based science inquiry microworld. *The Tenth International Conference of the Learning Sciences* (July 2-6, Sydney, Australia).

Hershkovitz, A., Baker, R. S. J. d., Gobert, J., Wixon, M., & Sao Pedro, M. (2013). Discovery with models: A case study on carelessness in computer-based science inquiry. *American Behavioral Scientist, 57*(10), 1480-1499.

Hershkovitz, A., & Nachmias, R. (2010). Online persistence in higher education Web-supported courses. *The Internet and Higher Education*, *14*(2), 98-106.

Kim, S. M., & Hwang, J. T. (2013). Technical change, heterogeneity in skill demand, and employment polarization. *Seoul Journal of Economics, 26*(3), 361-381.

Iglesias-Pradas, S., Ruiz-de-Azcárate, C., & Agudo-Peregrina, Á.F. (2014). Assessing the suitability of student interactions from Moodle data logs as predictors of cross-curricular competencies. *Computers in Human Behavior, 47*, 81-89.

Jawahar, I. M., & Elango, B. (1998). Predictors of performance in software training: Attitudes toward computers versus attitudes toward working with computers. *Psychological Report*, *83*(1), 227-233.

Kalef, L., Barrera, M., & Heymann, J. (2014). Developing inclusive employment: Lessons from Telenor Open Mind. *Work: A Journal of Prevention, Assessment and Rehabilitation*, *48*(3), 423-434.

Kher, H. V., Downey, J. P., & Monk, E. (2013). A longitudinal examination of computer self-efficacy change trajectories during training. *Computers in Human Behavior, 29*(4), 1816-1824.

Ktoridou, D., & Eteokleous-Grigoriou, N. (2011). Developing digital immigrants' computer-literacy: The case of unemployed women. *Campus-Wide Information Systems*, *28*(3), 154-163.

Laganá, L., Oliver, T., Ainsworth, A., & Edwards, M. (2011). Enhancing computer self-efficacy and attitudes in multi-ethnic older adults: A randomised controlled study. *Ageing and Society*, *31*(6), 911-933.

Lam, T., Cho, V., & Qu, H. (2007). A study of hotel employee behavioral intentions towards adoption of information technology. *International Journal of Hospitality Management, 26*(1), 49-65.

Lee, C. C., Czarja, S. J., & Sharit, J. (2008). Training older workers for technology-based employment. *Educational Gerontology*, *35*(1), 15-31.

Lin, H. (2000). Fluency with information technology. *Government Information Quarterly, 17*(1), 69-76.

Marakas, G. M., Yi, M. Y., & Johnson, R. D. (1998). The multilevel and multifaceted character of computer self-efficacy: Toward clarification of the construct and an integrative framework for research. *Information System Research*, 9(2), 126-163.

McDonald, D. S. (2004). The influence of multimedia training on users' attitudes: lessons learned. *Computers & Education*, *42*(2004), 195-214.

McQuiggan, S., Mott, B., & Lester, J. (2008). Modeling self-efficacy in intelligent tutoring systems: An inductive approach. *User Modeling and User-Adapted Interaction*, *18*(1-2), 81-123.

Merriam, S. B., Caffarella, R. S., & Baumgartner, L. (2007). *Learning in adulthood: A comprehensive guide* (3rd ed.). San Francisco: Jossey-Bass.

Mierswa, I., Wurst, M., Klinkenberg, R., Scholz, M., and Euler, T. (2006). YALE: Rapid prototyping for complex data mining tasks. *In Proceedings of the 12th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining* (August 20-23, Philadelphia, PA), 935-940.

Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analysis investigation. *Journal of Counseling Psychology*, *38*(1), 30-38.

Nielsen, J. (2006). Participation inequality: Encouraging more users to contribute. *Alertbox*. Retrieved 12 January 2015 from http://www.nngroup.com/articles/participation-inequality

Orpen, C., & Ferguson, C. (1991). The attitudes of accounting students to working with computers: A preliminary study. *Accounting & Finance*, *31*(2), 113-119.

Ouweneel, E., Schaufeli, W. B., & Le Blanc, P. M. (2013). Believe, and you will achieve: Changes over time in self-efficacy, engagement, and performance. *Applied Psychology: Health and Well-being*, *5*(2), 225-247.

Potosky, D. (2002). A field study of computer efficacy beliefs as an outcome of training: The role of computer playfulness, computer knowledge, and performance during training. *Computers in Human Behavior*, *18*(2002), 241-255.

Rex, K., & Roth, R. M. (1998). The relationship of computer experience and computer self-efficacy to performance in introductory computer literacy course. *Journal of Research on Computers in Education*, *31*(1), 14-24.

Saks, A. M. (1995). Longitudinal field investigation of the moderating and mediating effects of self-efficacy on the relationship between training and newcomer adjustment. *Journal of Applied Psychology*, *80*(2), 211-225.

Salanova, M., Grau, R. M., Cifre, E., & Llorens, S. (2000). Computer training, frequency of usage and burnout: The moderating role of computer self-efficacy. *Computers in Human Behavior*, *16*(6), 575-590.

San Pedro, M. O. Z., Baker, E., Heffernan, N., & Ocumpaugh, J. (2015). Exploring college major choice and middle school student behavior, affect and learning: What happens to students who game the system? *Proceedings of the 5th International Learning Analytics and Knowledge Conference*, 36-40.

Srour, I., Taymaz, E., & Vivarelli, M. (2014). *Globalization, technology and skills: Evidence from Turkish longitudinal microdata (No. 1405).* ERC-Economic Research Center, Middle East Technical University.

Topkaya, E. Z. (2010). Pre-service English language teachers' perceptions of computer self-efficacy and general self-efficacy. *Turkish Online Journal of Educational Technology*, *9*(1), 143-156.

Torkzadeh, G., & Koufteros, X. (1994). Factorial validity of computer self-efficacy scale and the impact of computer training. *Educational and Psychological Measurement*, *54*(3), 813-821.

Torkzadeh, G. & Van Dyke, T.P. (2002). Effects of training on Internet self-efficacy and computer user attitudes. *Computers in Human Behavior*, 18(5), 479-494.

Torkzadeh, R, Pflughoeft, K., & Hall, L. (1999). Computer self-efficacy, training effectiveness and user attitudes: An empirical study. *Behaviour & Information Technology*, *18*(4), 299-309.

Ventura, M. & Shute, V. (2013). The validity of a game-based assessment of persistence. *Computers in Human Behavior, 29*(6), 2568-2572.

Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies, 44*(3), 299-321.

Wu, J.-H., Wang, S.-C., & Lin, L.-M. (2007). Mobile computing acceptance factors in the healthcare industry: A structural equation model. *International Journal of Medical Informatics, 76*(1), 66-77.

Biographies

Dalit Mor is a graduate student at the Department of Mathematics, Science and Technology Education, in the School of Education, Tel Aviv University (Israel); she holds a B.Sc. in Computer Science. She is as a content and pedagogy advisor at Appleseeds Academy, an NGO the main purpose of which is to close the digital divide through the development and implementation of basic and advanced technology programs, vocational trainings, and life skills development.

Hagar Laks is a graduate student at the Department of Mathematics, Science and Technology Education, in the School of Education, Tel Aviv University (Israel); she holds a B.A. and a Teaching Certificate in Special Education. She is an elementary school teacher.

Arnon Hershkovitz is a Senior Lecturer at the Department of Mathematics, Science and Technology Education, in the School of Education, Tel Aviv University (Israel). He holds a Ph.D. in Science Education, an M.A. in Applied Mathematics and a B.A. in Mathematics and Computer Science. His research interests lie at the intersection of education and technology, using various methodologies, including educational data mining and learning analytics. Among his research interests are one-to-one computing in the classroom, learning/teaching processes in the social media era, information credibility assessment, student-teacher relationship, and genealogy as a unique lifelong learning experience in the information age.

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Nugent, G., Kohmetscher, A., Namuth-Covert, D., Guretzky, J., Murphy, P., & Lee, D-K. (2016). Learning from online modules in diverse instructional contexts. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 113-121. Retrieved from http://www.informingscience.org/Publications/3511

Learning from Online Modules in Diverse Instructional Contexts

Gwen Nugent
University of Nebraska-Lincoln, Lincoln, NE, USA

gnugent@unl.edu

Amy Kohmetscher
The Ohio State University, Columbus, OH, USA

kohmetscher.1@osu.edu;

Deana Namuth-Covert
The Ohio State University, Columbus, OH, USA

namuth-covert.1@osu.edu

John Guretzky
University of Nebraska-Lincoln, Lincoln, NE, USA

jguretzky2@unl.edu

Patrick Murphy
Iowa State University, Ames, IA, USA

ptmurphy82@gmail.com

DoKyoung Lee
University of Illinois, Urbana, IL, USA

leedk@illinois.edu

Abstract

Learning objects originally developed for use in online learning environments can also be used to enhance face-to-face instruction. This study examined the learning impacts of online learning objects packaged into modules and used in different contexts for undergraduate education offered on campus at three institutions. A multi-case study approach was used, examining learning impacts across a variety of course subjects, course levels (introductory and advanced undergraduate), student levels (undergraduate and graduate), and instructional goals (i.e., replacement for lecture, remediation). A repeated measures design was used, with learning data collected prior to viewing the online module, after completion of the module, and at the end of the semester. The study provided a broad examination of ways that online modules are typically used in a college classroom, as well as measured learning effectiveness based on different instructional purpose and usage contexts. Results showed the effectiveness of the modules in serving as a substitute for classroom lecture, remediation of course prerequisite material, introduction to content with follow-up lab practice, and review for final exams. In each of these cases, the use of the modules resulted in significant learning increases, as well as retention of the learning until the end of the semester.

Keywords: Learning objects, online learning, instructional context, multimedia instruction, online modules.

Editor: Gila Kurtz
Submitted: December 30, 2015; Revised: April 19, May 19, 2016; Accepted: May 21, 2016

Introduction

Online learning objects (LOs) are small, stand-alone, mediated content resources that can be reused in multiple instructional contexts, serving as building blocks to develop lessons, modules, or courses. While the definitions of learning objects vary, a comprehensive review of the literature showed that there generally are three common characteristics: they are digital, they support learning, and they are reusable (Moisey & Ally, 2007). LOs supporting face-to-face classes can serve many purposes: as background/review covering prerequisite course knowledge; to replace a lecture; to support, reinforce, and complement classroom presentations; introduce content for follow-up practice; and to serve as a review for an exam. The capability of LOs to support a variety of instructional contexts helps meet educational needs of the growing diversity of students in both K–12 and college settings. These characteristics contribute to an LO's *utility*, which refers to an LO's expanded use beyond that of the initial intended audience or educational setting (Namuth, Fritz, King, & Boren, 2005). Learning objects may also be classified in terms of uses in different educational contexts with the goal of guiding selection and usage by potential users. Proposed classifications include presentation, practice, simulation, conceptual models, information, and contextual representation (Churchill, 2007).

Research has documented the instructional effectiveness of learning objects (Guy & Lownes-Jackson, 2012; Kay, 2014; Nugent, Soh, & Samal, 2006; Tallmadge & Chitester, 2010) but little is known about their learning impact when used to meet different instructional objectives and when used in different learning contexts. The purpose of this study was to explore the learning impacts of learning objects packaged into online modules and used in different learning contexts. The study used a multi-case study approach involving professors from different universities teaching different undergraduate agricultural science classes. This multi-case study approach allowed study of online modules used in a variety of instructional contexts, with different student populations, and with varying instructional purposes. The repeated measures design also allowed examination of the proximal and distal learning impacts.

Methods

Description of Modules

Learning objects packaged into online modules were developed as part of a USDA grant (Agriculture and Food Research Initiative Competitive Grant No. 2011-68005-304111) designed to expand academic and outreach curricula in the broad areas of agronomy and biofuel. The modules contained stand-alone content and appropriate assignments and included a combination of video, animations, graphics, text, and quizzes. The videos could be narrated PowerPoints, tours/demonstrations of field techniques, demonstrations of calculations, or links to YouTube resources. The modules were designed to promote learner control of the navigation and viewing of the material. Students could freely move between pages, and watch, pause, and rewind the video components. Students could also click on designated terms and access a glossary. There were also links to external content. These strategies took advantage of the capabilities of online instruction to prompt active student response, which has been shown to result in greater mastery of material (Freeman et al., 2014; Nugent et al., 2009). Strategies also are forms of learner control of the lesson, which has been shown to be important to effectiveness (Windle, McCormick, Dandrea, & Wharrad, 2011).

The modules were developed following an instructional design process that included a) development of learning objectives; b) collaborating with content experts to refine objectives and write content; c) development of learning objects such as videos, graphics, written e-lessons, and quizzes; d) internal review by content experts and revision; e) public release of learning objects to students and public; and f) final revision based on evaluation data. Modules were developed using Adobe Flash Animation, Camtasia, and Moodle (LMS).

Study Design

Because the goal was to examine the effectiveness of the digital materials in a variety of learning contexts, a case study approach was used, examining learning impacts across a variety of course subjects, course levels (introductory and advanced undergraduate), student levels (graduate, undergraduate), and instructional goals (i.e., replacement for lecture, remediation). The case study approach provides a broad examination of ways that a module of packaged LOs is typically used in a college classroom, as well as evidence of the learning effectiveness based on different instructional purposes and usage contexts.

Each of the case studies followed a design using quantitative methods to assess the learning at various course time points. All cases used measures of proximal learning evidenced by assessment given immediately after completing the module, as well as distal learning as measured by course final exams. Learning data was collected at baseline (beginning of course, prior to introduction of module), post module (after students had completed the online module), and the end of the semester (final exam). This repeated measures design allowed examination of the immediate impact of the digital modules (from baseline to post-module), as well as the retention of learning to the end of the semester (from post-module to end of course).

Case Study One: Online Module as Primary Learning Material and Remediation

This case study compared the learning impact of a module intended as primary learning material in a 200 level university course (introductory level) versus use as remediation and refresher for prerequisite content for a more advanced class. The study involved use of a single module, "Perennial Grass Growth and Development," (http://passel.unl.edu/communities/index.php?idinformationmodule=1130447263&idcollectionmodule=1130274200) used by two different professors at two different universities. The first professor used the module as a substitute for a single lecture in a 200 level undergraduate soil science class. Students in this class (n = 68) represented a mix of sophomores (25%), juniors (45%), and seniors (30%). The majority were carrying a GPA of 3.0–3.4. Most were male (91%), and classified themselves as agronomy majors (52%). Eighty-five percent of the students reported that the course was required for their major.

The second professor, located at a different university, used the same module of learning objects to provide remediation and background material for a 400 level soil science class (advanced level). The demographics for this class (n = 13) represented it upper level status, with 46% graduate students, 31% seniors, and 23% juniors. The gender split was 69% male and 31% female. Majors were varied, with typical majors being bioenergy and biological engineering.

Both professors used the same assessment consisting of 11 multiple choice questions that covered material presented in the module. They also followed the same data collection protocol, with the same quiz given at the beginning of the school year (baseline), after viewing the LOs (post-LO), and end of course (final exam). This sequence of assessments allowed for a repeated measures design with three data collection points.

Results

A split plot analysis with time as the within variable and course as the between showed no significant time by course interaction ($\Lambda = .96$, $F(2,72) = 1.68$, $p = .19$). However, the main effect for time was significant ($\Lambda = .35$, $F(2,72) = 67.12$, $p < .0001$, partial $\eta^2 = .65$), documenting changes in learning across the three time points. In order to isolate specific changes between time points, one-way within subjects ANOVAs were run, followed up by pairwise comparisons. Results showed significant increases in both courses from pre- to post-module—200 level class: $t(63) = 13.03$, $p < .0001$, $d = 1.60$; 400 level class: $t(12) = 4.99$, $p < .0001$, $d = 1.38$, and a nonsignificant change (slight decrease) from post-LO to final 200 level class: $t(63) = 1.13$, $p = .26$; 400 level class: $t(11) = 1.43$, $p = .18$). Figure 1 shows the pattern of results for the two classes.

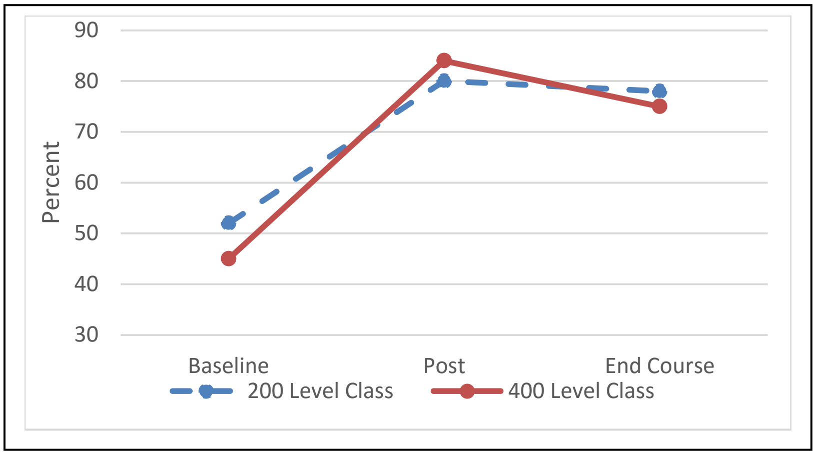


Figure 1: LO learning impacts in two classes. Percent represents the score or % of assessment questions answered correctly.

Discussion

The results provide clear evidence that the module had a similar learning impact, despite differences in its intended purpose for the two classes. Because the baseline results (pre-module) for the two classes were similar, it appears that, in general, students in the 400 level class did *not* have more content knowledge than the lower level course at the beginning of the course, as was expected. Thus, the module appeared to serve the same purpose in both classes—as primary learning material. It is important to note that results from both classes showed a significant increase in learning as a result of viewing the module, followed by a stabilization or retention of the learning. The use at two different universities with two different courses provides greater generalizability of results regarding the effectiveness of learning objects in increasing student learning and promoting learning retention.

Case Study Two: Module Used with Follow-Up Lab Practice

Case study 2 involved use of a different module focusing on "Establishment of Switchgrass and Other Perennial Grass Stands" (http://passel.unl.edu/communities/index.php?idinformationmodule=1130447188&idcollectionmodule=1130274200). The material required application of knowledge through the use of specific formulas and calculations to determine amount of seeds needed, percent germination, etc. The study examined a) the learning impact from viewing the packaged learning objects, b) the value-added learning impact of participating in a lab with practice with the content and needed calculations, and c) the retention effect to the end of the semester. A major area of inquiry was looking at the singular effect of the module and the combined effect of the module with additional lab practice.

The module was used in the same 200 level undergraduate soil science class from study 1, but in a different semester. This module replaced what the instructor typically presented in a lecture and was followed up with a lab where students had direct practice using the formulas and making the appropriate calculations. The learning was measured through presentation of a planting scenario that required calculations. The assessment was given at three time points: following student viewing of the LOs (a non-graded multiple choice quiz in the module itself), following the lab (a fill-in-the-blank graded quiz), and on the final exam. The multiple choice format for the first administration of the quiz was necessary to allow presentation and grading of the quiz within the module itself. However, the content was the same across the two instruments. Because of the extensive calculations involved, no pre-test was given. It was believed that students would not be able to successfully answer the questions, resulting in guessing, or would become frustrated, with possible impact on their course attitudes. Thus, the proximal learning impact of the module cannot be definitively determined. In order to maintain consistent data collection points across the case studies, we estimated a baseline score based on the expectation that students could have been expected to score around 25% by chance as shown in Figure 2.

Results

A one-way within subjects ANOVA was conducted, with time as the within subject variable. Results showed a significant effect for time ($\Lambda = .69$, $F(2,39) = 8.98$, $p < .001$, partial $\eta^2 = .32$). This main effect was followed up by pairwise dependent t-tests, showing a significant increase from post-viewing to post-lab ($t(42) = 4.39$, $p < .0001$, $d = .68$) and a nonsignificant increase from post-lab to post-final exam ($t(40) = .10$, $p = .92$). Figure 2 shows the pattern of learning effects.

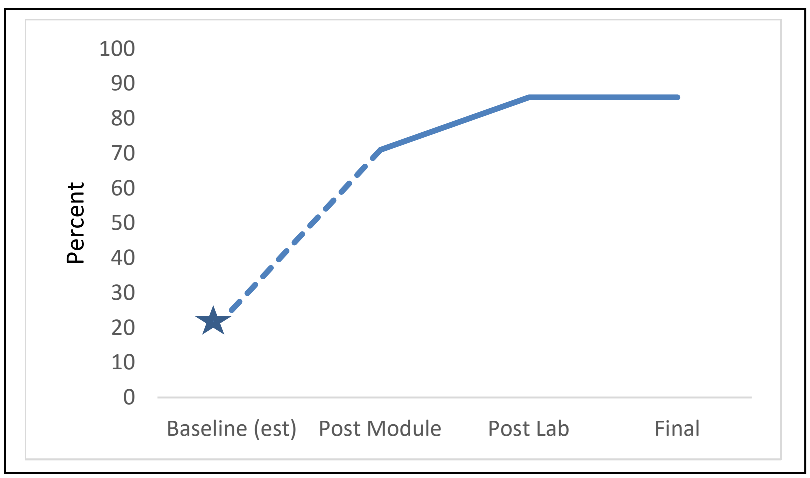


Figure 2. Learning impacts for LO module supplemented with lab-based practice in a single course (n = 50).

Discussion

Given the projected baseline score of around 25%, the 70% average score following module viewing represents considerable learning. Of major interest, however, is the additional gain realized through lab practice. Results suggest the value of LO module as introduction to material, but that full learning impacts may not be realized until students have time to practice and apply what they have learned. This practice effect may be most important for the type of learning material presented in this particular module, which focused on the use of formulas and calculations to solve problems as opposed to presentation of basic information or concepts. It is also possible that the practice components could be incorporated into the learning object package itself, reducing the need for follow-up lab practice and providing additional opportunities for active learning on the part of the learner. It is also important that, similar to results in case study 1, the learning realized from the additional practice stabilized and was retained throughout the semester.

Case Study Three: Module as Reinforcement and Review

Case study 3 extended the research on the effectiveness of learning object modules by examining their use as both reinforcement for previously learned material and review for the final exam. The module was used in a 200 level (introductory undergraduate), crop production equipment class (n = 42) with a mixture of sophomores (51%), juniors (21%), seniors (14%), and freshmen (2%). Seventy percent were majoring in Agricultural Systems Management and 79% were taking the course as a requirement for their major. The majority (44%) reported their GPA as between 2.5 and 2.9. All students in this course were male.

The module, which dealt with harvesting perennial grasses for bioenergy, contained content which an estimated 60–70% of the class had been exposed to in previous courses. The module was assigned as a replacement for two days of lecture. It was followed by a 15-item multiple choice exam the following week. The graded post-exams were returned with no feedback. The link to the module was also sent out prior to the final exam as a source of review. The data collection followed a similar pattern to previous studies: baseline, post-module, and as part of the final exam. As a result of student feedback, the module has since been split into two: 1) "Field Operations for Harvesting Herbaceous Bioenergy Crops: Mowing and Conditioning" and 2) "Field Operations for Harvesting Herbaceous Bioenergy Crops: Raking and Merging" (http://passel.unl.edu/communities/index.php?idinformationmodule=1130447261&idcollectionmodule=1130274200).

Results

A one-way within subjects ANOVA was conducted, with time as the within subject variable. Results showed a significant effect for time ($\Lambda = .39$, $F(2,35) = 26.98$, $p < .0001$, partial $\eta^2 = .61$). This main effect was followed up by pairwise dependent t-tests, showing a significant increase from pre- to post-LO ($t(36) = 3.73$, $p < .001$, $d = .61$), and a significant increase from post-LO to final exam ($t(36) = 4.37$, $p < .0001$, $d = .72$). Figure 3 shows the pattern of learning effects.

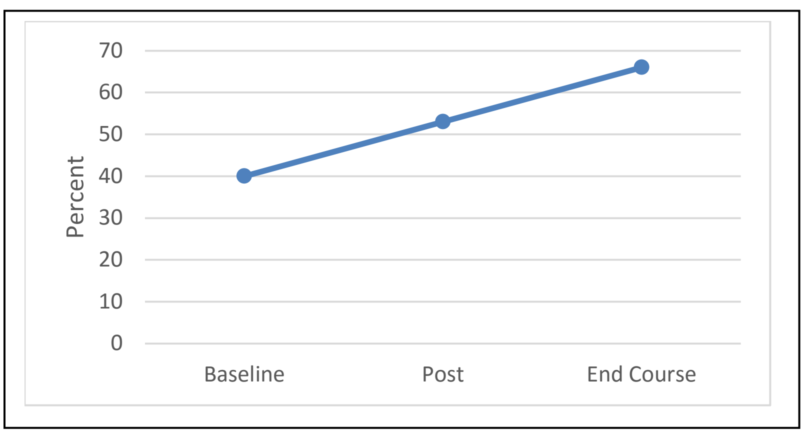


Figure 3. Learning impacts for LO module as reinforcement and review.

Discussion

In contrast to the pattern of results from the previous two studies, this study resulted in a linear trajectory, with no levelling off of learning impacts. As with the previous studies, the module had significant learning impact, but that initial impact was accentuated by its use as review for questions on the final exam. This result could be attributed to a dosage effect because students viewed the module twice. It is also possible that completing all course content allowed students to more effectively understand and integrate the specific module content when it was reviewed at the end of the course.

Overall Discussion

This paper provides insight into the effectiveness of LO modules used in different instructional contexts for on campus academic courses to meet diverse instructional goals. The three study cases (representing four separate courses) were deliberately selected to examine different uses of LO modules: a) substitute for classroom lecture, b) remediation for course prerequisite material, c) introduction to content with follow-up lab practice, and d) review for final exams. In each of these cases, the use of the module resulted in significant learning increases.

All cases involved measures of proximal learning evidenced by scores on an assessment given immediately or within a few days after completing module, as well as distal learning as measured by course final exams. The first study showed the learning effectiveness of the module as measured through comparisons between baseline scores and scores from the exam administered following student usage of the module. This study also demonstrated learning retention as shown by scores on the final exam. In short, the learning did not decay but was retained through the end of the semester. The second and third studies suggest ways in how this initial learning impact of the module can be further extended. Follow-up reinforcement of the content through practice further increased learning, as did the opportunity to reuse the learning object module as review for the final exam. It is also important that, similar to results in case study 1, case study 2 showed that the learning realized from additional practice stabilized and was retained throughout the semester.

All of the case studies described in this paper were in the curricular area of plant and soil science, limiting the generalization of study results to other subject areas. Nevertheless, results extend previous research on learning objects by documenting the more distal retention effect, which is an important educational goal. While we acknowledge that numerous factors promote retention, it is important that all four examples across the three case studies showed retention effects. This study also identified conditions under which learning can be further increased following initial viewing of LOs, including additional practice and review and reuse of the LOs.

References

Churchill, D. (2007). Towards a useful classification of learning objects. *Education Technology Research and Development, 55*, 479–497.

Guy, R. S., & Lownes-Jackson, M. (2012). Assessing the effectiveness of web-based tutorials using pre- and post-test measurements. *Interdisciplinary Journal of E-Learning and Learning Objects, 8*, 15–38. Retrieved from http://www.informingscience.org/Publications/1631

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences of the United States of America, 111*, 8410–8415. doi:10.1073/pnas.1319030111

Kay, R. (2014). Exploring the use of web-based learning tools in secondary school classrooms. *Interactive Learning Environments, 22*, 67–83.

Moisey, S., & Ally, M. (2007). Fulfilling the promise of learning objects. In M. Moore (Ed.), *The handbook of distance education* (pp. 323–337). Mahwah, NJ: Erlbaum.

Namuth, D., Fritz, S., King, J., & Boren, A. (2005). Principles of sustainable learning object libraries. *Interdisciplinary Journal of Knowledge and Learning Objects, 1*, 181–196. Retrieved from http://www.informingscience.org/Publications/419

Nugent, G., Kupzyk, K., Riley, S., Miller, L. D., Hostetler, J., Soh, L.-K., & Samal, A. (2009, October). Empirical usage metadata in learning objects. In *Proceedings of the 39th ASEE/IEEE Frontiers in Education Conference*, San Antonio, TX. Retrieved from http://fie-conference.org/fie2009/papers/1086.pdf

Nugent, G. C., Soh, L.-K., & Samal, A. (2006). Development and validation of learning objects. *Journal of Educational Technology Systems, 34*, 271–281.

Tallmadge, W., & Chitester, B. (2010). Integrating concepts using online tutorials in a freshman chemistry course. *Transformative Dialogues: Teaching and Learning Journal, 4*, 1–7.

Windle, R., McCormick, D., Dandrea, J., & Wharrad, H. (2011). The characteristics of reusable learning objects that enhance learning: A case-study in health-science education. *British Journal of Educational Technology, 42*, 811–823.

Biographies

Dr. Gwen Nugent is Research Professor of the Center for Research on Children, Youth, Families, and Schools at the University of Nebraska-Lincoln. Dr. Nugent coordinates development and research projects focusing on the impact of technology to improve student learning and teacher competencies, with special emphasis on multimedia instruction and on-line assessment. She has over 30 years' experience in the design, production, and evaluation of mediated instruction, and has served as project manager for over 300 multimedia projects designed in a variety of subject areas and for a variety of audiences. The majority of these projects are distributed nationally and internationally, and many have won national awards for their educational impact and effectiveness.

Ms. Amy Kohmetscher is an Instructional Development Specialist at The Ohio State University – Agricultural Technical Institute. She collaborates with faculty and IT specialists at OSU and nationally to develop instructional content for online delivery, designing instructional media to promote student and adult learning. She assists with evaluation and assessment of learning objects created.

Dr. Deana Namuth-Covert is currently a Professor and Director of Online Education and Outreach at The Ohio State University – Agricultural Technical Institute and College of Food, Agricultural and Environmental Sciences. She has 16 years of experience leading online STEM programs, some federally funded. She also teaches plant science classes/trainings, has advised online students and researches best practices. Her responsibilities include working closely with OSU faculty and staff to provide organizational direction in the prioritization, development and maintenance of course modules which serve both academic students and extension clientele. Her work also involves the creation, use and evaluation of learning object repositories.

Dr. John Guretzky is an Associate Professor and Grassland Systems Ecologist in the Dept. of Agronomy and Horticulture at the University of Nebraska-Lincoln (UNL). His research focuses on impacts of fire, grazing, and seeding on range and pastureland plant communities. He teaches courses in Forage Crop and Pasture Management and Forage Evaluation. His goal is to improve student understanding about the role of forages and grasslands in sustainable agriculture. Before joining UNL, John served as a Research Agronomist at the Samuel Roberts Noble Foundation in Ardmore, OK, from 2006 to 2009 and Postdoctoral Assistant with the U.S. Army Corps of Engineers Construction Engineering Research Laboratory in Champaign, IL from 2003 to 2006.

Dr. Patrick Murphy is currently the Education Co-Director for Cenusa Bioenergy in the Bioeconomy Institute at Iowa State University. His responsibilities include overall direction of Cenusa university education program which includes an online bioenergy curriculum, summer undergraduate internship program and graduate student webinar series and preparation of technical content for the bioenergy curriculum. In addition to his role at Iowa State University, he operates a research and engineering consulting firm serving the grain, feed and bioprocessing industries. He holds a doctorate in Agricultural Engineering and Biorenewables Resources and Technology from Iowa State University.

Dr. DoKyoung "D.K." Lee is an Associate Professor of Biomass and Bioenergy Crop Production and Extension Agronomist in the Department of Crop Sciences at the University of Illinois. He is a production agronomist with the broad range of research and educational background in the area of crop production, perennial grasses, soil science, and international agriculture and expertise in dedicated energy crop production. Currently, he is serving as the primary investigator of several biomass feedstock researches including CRP Management for Sustainable Biomass Feedstock Production as a part of the U.S.DOE & Sun Grant Regional Feedstock Partnership and Sustainable Biomass Feedstock Production-Dedicated Energy Crops funded by USDA, NIFA.

This page left blank intentionally

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Wandera, S., James-Waldon, N., Bromley, D., & Henry, Z. (2016). The influence of social media on collaborative learning in a cohort environment. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 123-143. Retrieved from http://www.informingscience.org/Publications/3452

The Influence of Social Media on Collaborative Learning in a Cohort Environment

Silas Wandera, Natasha James-Waldon, Debbi Bromley, and Zandra Henry
Wilmington University, New Castle, Delaware, USA

swand11164@wildcats.wilmu.edu; Natasha.r.James@wilmu.edu; dbron13923@wildcats.wilmu.edu; zhenr32235@wildcats.wilmu.edu

Abstract

This paper provides an overview of the impact that social media has on the development of collaborative learning within a cohort environment in a doctoral program. The researchers surveyed doctoral students in an education program to determine how social media use has influenced the doctoral students. The study looked at the following areas: a) the ability of social media use to develop a collaborative learning environment, b) access to social media content which supports learning, and c) whether social media use has contributed to the enhancement of the doctoral students' academic achievement and learning progress. As social media use and on-line learning become more prevalent in education, it is important to continue to understand the impact that social media has on improving students' ability to achieve their academic goals. This study provides insight on how doctoral students used social media and how social media use has influenced academic development in their cohort environment. In addition, this paper provides a discerning view into the role social media plays when developing a collaborative learning environment in a cohort.

Keywords: Social media; Collaborative learning; Learning environment; Doctoral program; Cohort

Introduction

In the quest to understand the influence of media and its benefits on education, researchers have historically looked at media as one component of learning and achievement with mixed reactions. As the concept of media evolved to include the phenomenon known as social media, studies have focused on this one particular aspect of media. Faraj, Jarvenpaa, and Majchrzak (2011) assert that there is a shift from centralization to decentralization of social media. This shift has allowed the knowledge sharing process to move from users consciously populating pre-constructed repositories to emergent knowledge contributions while unplanned connections evolve as individuals use social media to share knowledge (p. 40).

This research study began as a group project in the Disciplined Inquiry I & II courses of the Wilmington University, Doctorate of Education program. The

Editor: Gila Kurtz
Submitted: January 8, 2016; Revised: April 5, 2016; Accepted: April 16, 2016

evolving interest in examining the influence of social media on learning and the building of learning communities prompted four of the students at Wilmington University to develop the assignment into a research study. The study investigated the influence of social media on building collaborative learning communities. The research team conceptualized that the study would identify and reinforce the usage and purposes of social media (sharing documents, team building, sharing information, resources, and teaching others). The team also wanted to fulfill a component of the Organizational Leadership Professional Learning Community, established in their EDD 7000 course, Experiential Learning: Leadership Issues, by exporting cohort collegiate collaborative learning to new cohorts through a connection between social media and collaborative learning.

The study addressed three research questions:

1. How does the use of social media affect collaborative learning in a doctoral cohort environment?
2. Are there significant differences between cohort groups regarding social media accessibility?
3. To what extent do doctoral students think social media has an impact on their grades?

The research team defined social media as “Web based services that allow individuals to construct a public or semi-public profile within a bounded system, articulate a list of other users with whom they share a connection, and view and traverse their list of connections and those made by others within the system” (Boyd & Ellison, 2007, p. 211). The definition for “collaborative learning” was as an instructional method in which students at various performance levels work together in small groups toward a common goal. The students are, in part, responsible for facilitating each other’s learning and their own. Thus, the success of one student helps other students to be successful (Gokhale, 1995). The research team defined cohort as, “…a small group of learners who complete an entire program of study as a single unit” (Lawrence, 2002, p. 83). At Wilmington University, the Ed.D program cohorts are defined by track (OL, EL, & HL) and geographic location (Dover, Georgetown and New Castle).

Literature Review

Although there is an increasing amount of literature about the use and effectiveness of social media in higher education, it is still an emerging area of study with much to explore. Selwyn (2011) suggests that educators have traditionally been in the role of playing catch up when it comes to technology. The study notes that educators must consider, not if, but how they plan to include social media platforms into their current systems. Studying the effects of the virtual learning environment (VLE) for engineering students at Riyadh College of Technology in Saudi Arabia, BenSalah, Benselama, and Hennache (2009) posit that there is an ease of access to information in virtual learning but ultimately conclude, “There is no doubt that nothing will replace synchronous learning through face to face interaction but it is not always feasible for students to attend conventional classes” (p.69). Friedman and Friedman (2013) cite evidence that online learning or partial online learning can produce the same or better results as traditional, classroom-style learning.

Studies examining student perceptions of social media use within the academic environment offer varied results. A study conducted at Bournemouth University in six academic schools found that the use and application of social media differed amongst the different academic disciplines, where the Media School and the School of Tourism adopted much wider use of social media than did The Business School or The School of Applied Sciences (Kalashyan et al., 2013). McCarthy (2010) studied Facebook as an academic tool to blend virtual and real classroom environments for first year students at the University of Adelaide. This blending was observed in the study findings as responsible for "…increased peer interaction and academic engagement, two key factors in a positive first year experience" (McCarthy, 2010, p. 738). YouTube, as an educational enhancement, was studied by Buzzetto-More (2014). The researcher conducted a study of YouTube use in the learning environment, surveying 221 students at an eastern Maryland college. The study found that YouTube enhanced instruction, especially by students who prefer on-line courses. The study also concluded that mobile devices were most likely used in accessing the videos and that video length was also a determinant of use; however, frequency of social media use was not a determinant of student acceptance of YouTube for academic use (Buzzetto-More, 2014).

The use of Twitter in the educational environment was shown to engage both students and faculty "into a more active and participatory role" (Junco, Heilbergert, & Loken, 2010, p. 119). Although the study concluded that Twitter had a positive effect on engagement in students, it did not find the use of Twitter to have any effect on grades (Junco et al., 2010). Stollak, Vandenberg, Burklund, and Weiss (2011) studied the impact of social media use and grades, finding that students with smart phones spent more time engaged in social media but that there was not a negative relationship between GPA and social media use.

Beyond the effect social media may have on student grades or student perceptions, there is also the question of its impact in a collaborative learning environment. A study conducted at the University of Seville in Spain analyzing the influence of social media networks in collaborative learning found there was no relationship between the two constructs (Lopez-Bonilla & Lopez-Bonilla, 2013) but it was noted that this was an exploratory study and more research was needed. Studying the impact of social media on student engagement, Rutherford (2010) invited students in a pre-service teacher education program to complete an online survey that mirrored the National Survey of Student Engagement, a well-known instrument. The findings noted, "There was a positive correlation between the frequency of student use of social media and their relationships with their peers and instructors as well as how they describe the overall quality of instruction and the pre-service program" (Rutherford, 2010, p. 10). However, results did not indicate a significant relationship between frequency of social media use to discuss or complete school assignments (Rutherford, 2010).

Methodology

This study focused on the use of social media in the development of a cohort learning environment at Wilmington University in the Doctorate of Education program. The researchers wanted to study whether the doctoral cohorts were using any forms of social media in their interaction with each other, and if social media added value in meeting their academic requirements. The intent of the study was to provide valuable research on the use of social media and its impact on cohort success to future doctoral students and Wilmington University. The study was designed to answer the following research questions:

1. How does the use of social media impact collaborative learning in a doctoral cohort environment?
2. Are there significant differences between cohort groups regarding social media accessibility?
3. To what extent do doctoral students think social media has an impact on their grades?

Research Design

The survey (see the Appendix) was designed to gather both quantitative and qualitative data on how Ed.D doctoral students at Wilmington University use social media. Likert Scale questions were developed, with some open-ended questions included. The data collected looked at variables, which included age, gender, location, and doctoral track. There were some thematic questions posed to investigate the attitudes towards social media, collaborative learning, and comparative differences. The researchers worked collaboratively to develop a survey. The team met twice a week, via WebEx and GoToMeeting for several months to develop the questions. These questions were then reviewed, discussed, and after several iterations, a total of 47 questions were created. The researchers created the survey using the electronic survey tool Google Forms. The researchers piloted the survey to twelve (12) students in one program, in one location, and in one cohort (OL Program, Wilmington, Cohort 24). In addition, the survey questions were presented to the program chairperson to get feedback on the reliability and the validity of the survey.

There were 229 students enrolled in the Wilmington University Ed.D program, which consisted of 151 women and 78 men from Cohorts 22, 23, and 24. The 229 students represent all the students in the Educational Leadership, Higher Educational Leadership, and Organizational Leadership and Innovation tracks for the Ed.D program. In addition, this number also represented all the students on each of the three campuses – Dover, Georgetown, and New Castle – where the Ed.D program is housed. Cohort 22 began their doctoral studies in 2012, Cohort 23 in 2013, and Cohort 24 in 2014. With the assistance of the administrator for the Ed.D program, the survey was distributed, via email, to all the doctoral students in Cohorts 22, 23, and 24. The students were provided with an incentive for their participation. In the email distribution, the participants were informed that everyone was eligible to win one of five Amazon gift cards at $20 per person. The researchers later increased the incentive to six winners, with two at each of the three locations where the program was offered.

The data were analyzed using SPSS, descriptive statistics, and correlational statistics. In the original analysis, the researchers determined that the Likert scale that was originally developed had too many categories to enable the researches to form conclusions with the data. The researchers decided to collapse the data categories to provide a better review of the data. The categories went from five to three – (1) strongly agree/agree, (2) neutral, and (3) strongly disagree/disagree. This provided the researchers with results that will be discussed in the results section of this paper.

Wilmington University's Human Subject Review Committee granted the researchers permission to conduct the study. Professors who were teaching the various participants at the time the study was being conducted were asked to encourage the members of their classes to participate. This study was done in conjunction with two course requirements for the Ed.D. Program, and was overseen by the Chair of the Ed.D program's Organizational Leadership and Innovation track, Dr. Lynne Svenning.

Results

Table 1 outlines the demographics of the survey participants by gender, age, marital status, cohort, track, and location. Two hundred twenty-nine (229) were invited to participate in the study. One hundred nineteen (119) students responded (response rate 52%), of which seventy-one percent (71%) of respondents were female students. Eighty percent (80%) of the participants classified their relationship status as living with someone or in a shared household, only thirteen percent (13%) were single or in non-shared household.

Table 1. Demographics of Survey Participants (n=119)

Characteristics	%
Gender	
Male (N = 35)	29
Female (N = 84)	71
Age	
23-44 (N = 64)	54
45+ (N = 55)	46
Relationship Status	
Shared household	87
Non-shared household	13
Cohort	
22 (N = 49)	41
23 (N = 33)	28
24 (N= 37)	31

Characteristics	%
Track	
Education Leadership (EL)	44
Organization & Innovation Leadership (OL)	33
Higher Education Leadership (HL)	23
Campus Location	
New Castle	56
Georgetown	20
Dover	24

Table 2 lists the different social media tools and the percent of use for each social media tool. Online meeting tools (WebEx/GoToMeeting), Wikis, Instagram, and Twitter were the most rarely used social media tools. Only 20% of the respondents used them sometimes or frequently while 80% rarely used them. Conversely, Blackboard and YouTube were social media tools that were either sometimes or frequently used, with a combined total of sixty percent (60%) in this category.

Table 2. Social Media Use by Cohort in Program (Survey Questions 7-17)

	Do you use any of the following social media?		
Social Media Tools	Rarely %	Sometimes %	Frequently %
Facebook	48	24	28
Google+	50	29	21
Blackboard	33	**22**	**45**
Online Meeting tools (WebEx/GoToMeeting)	80	10	10
Wikis	86	13	1
Skype	79	17	4
YouTube	28	**42**	**30**
Instagram	88	4	8
LinkedIn	64	18	18
Twitter	88	8	4
Other (e.g., Pinterest, Vine, Tumblr, WhatsApp)	80	10	10

Research Results

Research Question 1: How does the use of social media impact collaborative learning in a doctoral cohort environment?

Social Media's impact on collaborative learning was assessed by multiple survey response questions that thematically fell into the collaboration and teamwork category. A chi-square test of independence was performed to examine the differences between Cohorts 22, 23 and 24 in relationship to their perceived response on listed questions on Table 3. The findings within the cohorts indicated that over sixty percent (60%) of all respondents agreed that social media made it easier to share work with their team members and there was a significant difference (X^2 [4, N = 119] = 9.96, $p < 0.05$).

Table 3. Chi-Square Test Analysis for Social Media and Collaboration

Survey Question	X^2 Test Results
1. Social media sites make it easier to share work with team members	X^2 (4, N = 119) = 9.96, $p < 0.05$
2. Social media usage is an essential part of developing a collaborative learning communities	X^2 (4, N = 119) = 13.36, $p < 0.05$
3. My use of social media as a collaborative tool has increased my access to information	X^2 (4, N = 119) = 14.80, $p < 0.05$
4. Social Media increases my engagement in the collaborative learning process.	X^2 (4, N = 119) = 15.00, $p < 0.05$
5. Collaborative learning would be impacted if social media was not utilized	X^2 (4, N = 119) = 14.37, $p < 0.05$

There were significant differences in determining whether social media usage is an essential part of developing a collaborative learning community. Sixty-eight percent (68%) of the Cohort 24, forty-two percent (42%) of Cohort 23 and twenty-nine percent (29%) of Cohort 23 agreed social media develops collaborative learning. Similarly, when we examined the relationship between the track and the ease social media provides to share work with the team members the relationship was also significant, X^2 (4, N = 119) = 10.15, $p < 0.05$. Seventy-seven percent (77%) of the sub group of OL track students in all three cohorts agreed that social media allows participants to share academic work.

Research Question 2: Are there significant differences between cohort groups regarding social media accessibility?

Seventy-three percent (73%) of respondents agreed that social media was accessible and cost effective. However, there was some significant difference within the groups X^2 (3, N = 119) = 11.04, $p < 0.05$. Sixty-five percent (65%) of the Cohort 24, Eighty-five percent (85%) of Cohort 23 and Seventy-one percent (71%) of Cohort 22 agreed that social media was cost effective. Chi-square tests were also used to determine the relationship between the cohorts. Similarly, the same result was evident on the analysis of social media's ability to provide information that may not be as quickly accessible by other means, the relationship was also deemed significant, X^2 (4, N = 119) = 12.57, $p < 0.05$.

In examining the relationship between age and the cost effectiveness (cheaper access) of social media, over seventy percent (70%) of the participants agreed that social media is cost effective. Eighty-percent (80%) of the participants between ages 44 and below agreed social media is cost effective compared to Sixty-six percent (66%) of the participants between ages 45 and above.

Research Question 3: To what extent do doctoral students think social media has an impact on their grades?

The respondents were asked their perception of whether social media had a direct impact on their grades (See the Appendix). Fifty-six percent (56%) disagreed with the question that social media has had a direct impact on their grades. The relationship between the cohorts was significant X^2 $(4, N = 119) = 10.53$, $p < 0.05$.

The open-ended responses posited two questions:

Question 1: Describe how social media provides information that enhances your learning as a doctoral student?

Eighty-eight (88) open-ended responses were received, of which, seventy-seven percent (77%) of the participants felt that social media enhanced their learning experience as doctoral students.

Comments

Enhanced

> "Social Media helps to communicate across boundaries"
>
> "Social Media provides connection and encouragement"

Not-Enhanced

> "Social Media is not an educational tool"
>
> "Social Media has no impact on my studies"

Question 2: Describe how the use of Social Media within your cohort has enhanced the development of the collaborative learning community.

Eighty-six (86) open-ended responses were received, of which fifty-eight percent (58%) felt Social Media enhanced collaborative learning communities.

Comments

Enhanced

> "Social media has allowed me to work within my small group on projects at a more effective time and location. By that I mean, that instead of having to schedule a phone conference or an additional face to face meeting in our already busy schedules, we can collaborate in real-time by scheduling a convenient meeting time (usually the middle of the night), or we can share our materials and then comment at our own convenience. Drop articles for consideration. Stay in touch via smartphone, Surveys, Calendar programs. Shout outs for assistance. Support. Social aspects."

Not-Enhanced

> "I think it has had the opposite effect because some members are not comfortable with it, and some members are attempting to force members to use it when they don't want to."

Discussion

The study produced results on the impact that social media has on the development of collaborative learning within a cohort environment in a doctoral program. The study revealed that the doctoral students perceived that social media had no significant impact on academic success. However, social media did provide students a platform to share ideas efficiently. Junco et al. (2011) had similar findings that student engagement was positive but students did not perceive a positive impact on academic success. Despite, the perception that social media had little impact on academic success, what was unique about the doctoral students is the selection of the social media they used. The doctoral students did find it beneficial to use social media that had some meaningful relationship with their academic work. Blackboard, which is Wilmington University's Learning Management System (LMS) and YouTube, which offers both academic and entertainment content, were prevalent among students. Students reported that these two social media forums enhanced their learning and understanding.

Amongst the cohorts, the most recent (newest) cohort, Cohort 24, was more engaged in social media than Cohorts 22 and 23. Research has continued to indicate past experiences with social media or technology affects the perceptions about technology in general (Burke & Moore, 2003). Since the technology influx is the norm in today's world, access to social media was a non-issue among all the doctoral students who participated in the research.

Conclusion

In this study, the use of social media within a cohort group was reported by students to enhance the ability of the cohort to collaborate and share information. Social media was also seen as an effective learning tool. Newer cohorts are using social media more frequently than the older cohorts. However, social media was not seen as a tool that enhances student grades or academic achievement even though it worked well as a collaborative tool. If social media is able to enhance collaboration among cohort members, perhaps its value need not rest in grade enhancement or academic achievement. Lawrence (2002) suggests that, "Co-creating knowledge through collaborative learning and experiential knowing is identified as an important outcome of cohort learning" (p. 83). Perhaps some of social media's strength lies in its ability to create additional opportunities for learners to gather and share.

Limitations of the Research

This study was conducted across three distinct programs (OL, HL, and EL) within the Doctorate of Education program in the College of Education at Wilmington University, and there are some differences among that student population. However, a limitation of this research is the narrow focus of the participant population. This study was not administered across the entire university nor was it given to any other doctoral program within the university. In addition, the responses were only self-reports and the actual performance of academic achievement was not measured. It was also noted by the research team that some of the survey questions were ambiguous to the population surveyed and that ambiguity may have affected their responses.

Future research surveys should be presented to people who are familiar with social media use and those who are not. In addition, future studies might benefit from a broader based student population in different colleges and different fields of study within a university or among several different universities.

References

BenSaleh, M. S., Benselama, A. S., and Hennache, A. S. (2009). Designing and evaluating the effectiveness of the virtual learning environment (VLE) in Saudi Arabia: A review and recommendations. *Conference of the International Journal of Arts and Sciences, 1*(20), 59-69.

Boyd, D., & Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication, 13*(1), 210-230. doi 10.1111/j.1083-6101.2007.00393.x

Burke, L. A. & Moore, J. E. (2003). A perennial dilemma in OB education: Engaging the traditional student. *Academy of Management Learning & Education, 2*(1), 37-53.

Buzzetto-More, N. A. (2014). An examination of undergraduate student's perceptions and predilections of the use of YouTube in the teaching and learning process. *Interdisciplinary Journal of E-Learning and Learning Objects, 10,* 17-32. Retrieved from http://www.ijello.org/Volume10/IJELLOv10p017-032Buzzetto0437.pdf

Faraj, S., Jarvenpaa, S. L., & Majchrzak, A. (2011) Knowledge collaboration in online communities. *Organization Science, 22*(5), 1224-1239.

Friedman, L. W., & Friedman, H. H. (2013). Using social media technologies to enhance online learning. *Journal of Educators Online, 10*(1), 1-22.

Gokhale, A.A. (1995). Collaborative learning enhances critical thinking. *Journal of Technology Education, 7*(1). Retrieved from http://scholar.lib.vt.edu/ejournals/JTE/v7n1/gokhale.jte-v7n1.html

Junco, R., Heibergert, G., & Loken, E. (2010). The effect of Twitter on college student engagement and grades. *Journal of Computer Assisted Learning, 27*(2), 119-132. doi: 10.1111/j.1365-2729.2010.00387.x

Kalashyan, I., Kaneva, D., Lee, S., Knapp, D., Roushan, G., & Bobeva, M. (2013). Paradigm shift – Engaging academics in social media – The case of Bournemouth University. *Proceedings of the International Conference on E-Learning,* 662-665.

Lawrence, R.L. (2002) A small circle of friends: Cohort groups as learning communities. *New Directions for Adult & Continuing Education, 2002*(95), 83-92.

Lopez-Bonilla, J., M., & Lopez-Bonilla, L., M. (2013). Exploring the relationship between social networks and collaborative learning. *British Journal of Educational Technology, 44*(5), E139-E1-42. doi:10.1111/bjet.12003

McCarthy, J. (2010). Blended learning environments: Using social networking sites to enhance the first year experience. *Australasian Journal of Educational Technology 26*(6), 729-740.

Rutherford, C. (2010). Using online social media to support preservice student engagement. *Journal of Online Learning and Teaching, 6*(4), 703-711.

Selwyn, N. (2011). Social media in higher education. *The Europa World of Learning 2012.* Retrieved from www.worldoflearning.com.

Stollak, M., Vandenberg, A., Burklund, A., & Weiss, S. (2011). Getting social: The impact of social networking usage on grades among college students. In Proceedings from *ASBBS Annual Conference, 18*(1), 859-865.

Appendix

Social Media Influence on Collaborative Learning Communities

Please read the research consent and accept to complete the survey:

We are seeking your assistance in the completion of a study to examine how the use of social media has influenced the development of a collaborative learning community within the cohort environment in Wilmington University's Ed.D program.

We are four doctoral students in the OL track of Cohort 24 in the program. It is not the intent of this research study to show preference to one cohort over another or to present any cohort in a positive or negative manner but to compare the information received to assist with the descriptive and correlational analysis of the data collected.

The survey should take no more than 10 to 15 minutes to complete. It includes questions about your use of social media as a member of a cohort in the Ed.D program at Wilmington University. As well, we ask for some demographic information (e.g., age, marital status, cohort number, cohort section, and cohort location) so that we can discover findings and general traits of cohort groups.

No risks or discomforts are anticipated from taking part in this study. If you decide to quit at any time before you have finished the questionnaire, your answers will NOT be recorded. Your participation is voluntary; you are free to withdraw your participation from this study at any time. If you do not want to continue, you can simply leave this website. If you do not click on the "submit" button at the end of the survey, your answers and participation will not be recorded. Only the researchers will see your individual survey responses.

The results of the study will be used for scholarly purposes only. The results from the study may also be presented in educational settings and at professional conferences, and the aggregate results might be published in a professional journal. If you have concerns or questions about this study, please contact Natasha James-Waldon , J.D., MPS at natasha.r.james@wilmu.edu or Wilmington University, Doctorate of Education, Organizational Leadership Program Chairperson, Dr. Lynne Svenning at lynne.l.svenning@wilmu.edu .

The Human Subjects Review Committee (HRSC) of Wilmington University has approved the proposed research.

By beginning the survey, you acknowledge and accept that you have read this information and agree to participate in this research. We thank you in advance for your participation.

Please Select Accept to complete the survey *

○ Accept

○ Decline

1. Please tell us about yourself: Your cohort number *

Choose

2. Your cohort track *

Choose

3. Your campus location *

Choose

4. Gender *

○ Male 1

○ Female 2

5. Which of the following best describes your current relationship status? *

- ○ 1 = Married
- ○ 2 = Widowed
- ○ 3 = Divorced
- ○ 4 = Separated
- ○ 5 = In a domestic partnership or civil union
- ○ 6 = Single, but cohabiting with a significant other
- ○ 7 = Single, never married

6, Select the appropriate age range: *

- ☐ 23-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55-64
- ☐ 65 or better

Do you use any of the following social media in your program? *

	Never use 1	Almost never 2	Occasionally/Sometimes 3	Almost every time 4
7. Facebook	○	○	○	○
8. Google+	○	○	○	○
9. Blackboard Collaborate	○	○	○	○
10. WebEx/Training Center/GoToMeeting	○	○	○	○
11. Wikis	○	○	○	○
12. Skype	○	○	○	○
13. YouTube	○	○	○	○
14. Instagram	○	○	○	○
15 LinkedIn	○	○	○	○
16. Twitter	○	○	○	○
17. Other (e.g., Pinterest, Vine, Tumblr, WhatsApp)	○	○	○	○

18. Which device(s) do you use to access social media sites? (Select all that apply.) *

- [ ] Smartphone 1
- [ ] Tablet 2
- [ ] Desktop/Laptop Computer 3
- [ ] Other Wi-Fi enabled device (TV, Blu-Ray player, gaming system, etc.) 4
- [ ] Other 5

19. How many hours a week are you employed? *

- ○ 0 hrs-I'm not working
- ○ 1-9 hours a week
- ○ 10-19 hours a week
- ○ 20-29 hours a week
- ○ 30-39 hours a week
- ○ 40+ hours a week

20. Approximately how many hours a week do you use social media? *

- 0 hrs - I'm not using Social Media
- Less than an hour a week
- 1-2 hours a week
- 2-3 hours a week
- 3-4 hours a week
- 4+ hours a week

21. Approximately how many hours a week do you use social media for classwork or collaboration? *

- 0 hrs - I'm not using Social Media
- Less than an hour a week
- 1-2 hours a week
- 2-3 hours a week
- 3-4 hours a week
- 4+ hours a week

22. Given a choice, would you use social media for collaboration in your cohort learning? *

- [ ] Never 1
- [ ] Rarely 2
- [ ] Sometimes 3
- [ ] Often 4
- [ ] Always 5

Indicate your opinion about the following statements using the scale below: *

	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5
23. Social media is an effective tool to communicate with the members of your cohort.	○	○	○	○	○
24. Social media usage is an integral part of a collaborative learning communities	○	○	○	○	○
25. Social media has had a direct impact on my grades	○	○	○	○	○
26. Social media usage is an essential part of developing a collaborative learning communities	○	○	○	○	○
27. Social media sites are an effective substitute for face-to -face communication	○	○	○	○	○
28. Social media sites are a useful way to communicate information	○	○	○	○	○
29. Social media sites are easy to use.	○	○	○	○	○
30. Social media sites make it easier to share work with team members	○	○	○	○	○
31. Social media sites have increased our ability to work as a team.	○	○	○	○	○

32. Social media sites create learning opportunities for team members	○	○	○	○	○
33. My use of social media as a collaborative tool has increased my access to information	○	○	○	○	○

34. In general, how satisfied are you with the current use of social media in your cohort group? *

☐ Very dissatisfied 1

☐ Generally dissatisfied 2

☐ Neither 3

☐ Generally satisfied 4

☐ Very satisfied 5

Indicate your opinion about the following statements using the scale below: *

	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5
35. Social Media allows me to share academic experiences.	○	○	○	○	○
36. Social Media assists me with understanding course material	○	○	○	○	○
37. Social Media increases my engagement in the collaborative learning process.	○	○	○	○	○
38. Social Media is an effective way to communicate in a collaborative learning community.	○	○	○	○	○
39. Social networking tools (e.g. Facebook, Twitter, Google+) help me with learning	○	○	○	○	○
40. Collaborative learning would be impacted if social media was not utilized	○	○	○	○	○
41. Social media provides information that may not be as quickly accessible by other means	○	○	○	○	○

42. Social media has increased the amount of information available for collaborative learning communities	○	○	○	○	○
43. Social media is preferred over face- to-face for collaborative learning purposes	○	○	○	○	○
44. Social media is cost effective.	○	○	○	○	○
45. It would be difficult to maintain a collaborative learning community without the use of social media	○	○	○	○	○

46 .Describe how social media provides information that enhances your learning as a doctoral student?

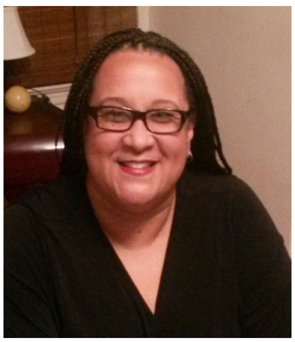
Your answer

47. Describe how the use of social media within your cohort has enhanced the development of the collaborative learning community. Please explain?

Your answer

Biographies

Silas Wandera, MS, is currently, an Implementation Success Manager at an Online Digital Curriculum provider based in Seattle, WA. Mr. Wandera has managed and implemented digital online programs for over 100 learning institutions, delivered over 500 professional development sessions and professional developed over 2000 teachers. He resides in NJ, USA. Mr. Wandera also holds a Masters of Science in Education and BSc in Computer Science from City University of New York (CUNY). He is also a second year doctoral student at Wilmington University in Delaware. He has had experience in teaching mathematics and computer technology for over 8 years.



Natasha James-Waldon, J.D., MPS, is the Director of Compliance and Community Engagement for the Jewish Renaissance Foundation. She is also an adjunct faculty member at Wilmington University. Ms. James-Waldon holds a Juris Doctorate and a Masters of Professional Studies in Media Administration from Syracuse University. She also holds a BA in Journalism from Temple University. Ms. James-Waldon is currently a second year doctoral student in the Ed.D, Organizational Leadership and Innovation program at Wilmington University, New Castle DE.

Debbi D. Bromley, MS, is the Senior Vice President of Human Resources at Genex Services, LLC. in Wayne, PA. She joined Genex in January of 2007 and is responsible for the development and management of the human resources and corporate administration functions. In addition to her experience in healthcare, Ms. Bromley has also held human resources leadership roles in broadcasting, technology and retail. Ms. Bromley holds a BA degree from Fairleigh Dickinson University where she majored in Psychology and Sociology and an MS degree in Organization Development and Leadership from the Philadelphia College of Osteopathic Medicine. She is currently a second year doctoral student in the Ed.D, Organizational Leadership and Innovation program at Wilmington University, New Castle, DE.

Zandra Henry, MS, is the Program Operation's Director for First State Community Action Agency, Inc. Ms. Henry is an alumnus of the University of Delaware in Newark, Delaware and Wilmington University of New Castle, Delaware having received her Bachelors of Science, Major: Sociology /Education from the University of Delaware and Masters of Science Community Counseling from Wilmington University. She serves as a mediator for the Center for Community Justice at People's Place II in Milford, Delaware. Ms. Henry is currently a second year doctoral student in the Ed.D, Organizational Leadership and Innovation program at Wilmington University, New Castle, DE.

This page left blank intentionally

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Aharony, N. & Bar-Ilan, J. (2016). Students' perceptions on MOOCs: An exploratory study. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 145-162. Retrieved from http://www.informingscience.org/Publications/3540

Students' Perceptions on MOOCs: An Exploratory Study

Noa Aharony and Judit Bar-Ilan
Department of Information Science, Bar-Ilan University, Ramat Gan, Israel

Noa.Aharony@biu.ac.il; Judit.Bar-Ilan@biu.ac.il

Abstract

MOOCs are open, online courses that use information technologies to enhance the learning experience and attract various people from the entire world. The current study uses the Technology Acceptance Model (TAM), as well as personal characteristics such as learning strategies, cognitive appraisal, and Kuhlthau's (1991) model of information seeking as theoretical bases for defining factors that may influence students adopting MOOCs in their learning process, as well as describe their feelings during the learning process. The study was conducted in Israel during the 2014 academic year, and used both quantitative and qualitative techniques and involved 102 students who participated in a MOOC as part of the requirements in an offline course. They were requested to keep study diaries. The quantitative analysis revealed that perceived usefulness (PU) and perceived ease of use (PEOU) have a major influence on the intention to enroll in a MOOC. PEOU can be increased by improving the current MOOC platforms. PU can also be improved by providing content that suits the students' needs. The qualitative analysis showed mood changes over time; the feelings of uncertainty were replaced by expressions of confidence. We found that students have different needs and expectations. Therefore, the MOOC's platforms should provide multiple options to accommodate these needs.

Keywords: MOOC, Technology Acceptance Model, learning strategies, cognitive appraisal

Introduction

Massive Online Open Courses (MOOCs) are online courses that attract various people from the entire world. They are defined as open, free, easily accessed, participatory and distributed courses (Pappano, 2012). Siemens (2013) suggests that MOOCs are a combination of innovations and use of technology that provide learning opportunities for vast number of individuals. Daradoumis, Bassi, Xhafa, and Caballe (2013) add that the power of MOOCs is based on the active engagement of huge numbers of self-organizing learners and on the connections they create using the course platform and other social interactions tools. Glance, Forsey, and Riley (2012) found that the main characteristics of MOOCs are: courses that include a large number of learners, online and open access, lectures conveyed as videos (8-12

Editor: Gila Kurtz
Submitted: April 3, 2016; Revised: July 5, July 19, 2016; Accepted: July 21, 2016

minutes) followed by formative quizzes, automated assessment that involves peer and/or self-assessment, and online forums and requests for peer help and discussion. Nan, Himanshu, Afroditi, Guillaume, Jan, and Dillenbourg (2014) suggest that students who take MOOCs courses prefer studying in groups as they feel more connected. Summing up, the unique features of MOOCs are: massiveness, openness, and peer assessment. However there are several drawbacks associated with MOOCs: because they involve many participants, often thousands (hence the "massive" in MOOC), the management of the course is quite complex and tutor involvement is limited to most critical tasks. In addition, it is not possible for the human instructor to review and grade all assignments, thus, they are usually either computer-graded or assessed by peers taking the course. Further, there is a high dropout rate, and only about 5% to 15% of participants finish the course (Daradoumis et al., 2013). Moreover, one should take into account plagiarism and security vulnerabilities (Miguel, Caballe, & Proeto, 2013).

MOOC models are changing rapidly and Siemens (2013) distinguishes among xMOOCs, cMOOCs, and quasi-MOOCs. xMOOCs duplicate online the traditional model of an expert teacher and learners as knowledge consumers with video tutorials and graded tasks. cMOOCs focus on the connectivist pedagogical approach that considers knowledge as a networked state and learning as the process of creating these networks, using online and social tools. Quasi-MOOCs pertain to web-based tutorials such as Open Educational Resources (OER), that are not courses and do not involve social interaction.

Several studies have examined the MOOC phenomenon. Christensen, Steinmetz, Alcorn, Bennett, Woods, and Emanuel (2013) explored who takes MOOCs and why by conducting an online survey among the participants of a specific course. They found that the student population tends to be young, well educated, employed and from developed countries. Students take MOOCs because they would like to advance in their present jobs and to satisfy their curiosity. Data from the University of Pennsylvania Graduate School of Education (2013) show that MOOCs have only few active users, that students' "engagement" falls off, particularly after the first two weeks of the course, and that only a few students finish the course. Several researchers have suggested frameworks aiming to improve and personalize management, delivery, efficiency and evaluation of MOOCs (Daradoumis et al., 2013; Grover, Franz, Schneider, & Pea, 2013).

So far only a few studies addressed students' attitudes towards MOOCs. Joseph and Nath (2013) conducted a pilot study of 35 students regarding the attitudes towards informal online learning (taking part in a MOOC) as part of a regular academic course. The students filled in pre- and post-MOOC surveys. One of the questions that appeared both at the pre- and the post-survey was whether they plan to take a MOOC course on a topic of interest in the near future. In the pre-course survey, only 11% answered 'yes', but the percentage increased to 66% in the post-course survey. An even smaller, qualitative study with 26 students was conducted by Carolan and Magnin (2013). The largest study that we were able to locate followed a MOOC run on Coursera on bioelectricity by Roger Barr from Duke University (Belanger & Thorton, 2013). The students participating in the course filled in pre- and post-course questionnaires. There is no information on the number of respondents to the pre-course survey. The post-course survey was filled in by 105 students. The objective of the surveys was to understand motivations for enrolling (fun was a major motivation in the pre-course survey and general interest in the topic in the post-course survey); to learn about the students' course activities; their attitude towards bioelectricity – the topic of the course; their reported learning outcomes; and factors promoting and barriers to course completion. Some of these questions were open ended, and quotations supporting the claims are presented, while for the other questions, simple descriptive statistics is given. More recently, Alraimi, Zo, and Ciganek (2015) suggested that the intention to continue using MOOCs was influenced by the course's perceived reputation, perceived openness, perceived usefulness and user's overall satisfaction. Xu (2015), who investigated MOOCs in China, reported that students' intentions regarding MOOCs were affected by their subjective norms and by the perceived usefulness of the course. Lately, Zhou (2016) suggested that attitudes towards MOOCs and perceived behavioral control were major factors that influenced students' intentions to use MOOCs. Thus so far only a few studies tried to explore motivation to participate and to complete courses offered on MOOCs.

Due to the proliferation of MOOCs, it is essential to understand whether students are willing and ready to accept this new approach of learning where courses are massive and open and students' assessment is quite different, and if not, instructors and course designers should understand what obstacles students face, and how they can help them overcome them. In the current study we will try to understand how students perceive the MOOC phenomenon and how they feel when studying courses offered on the MOOC platform. In addition, we will focus on students' characteristics and attitudes in order to understand what influences positive attitudes towards learning in MOOCs. We believe that the research outcomes may contribute to an understanding of the variables that influence students' attitudes towards MOOCs.

The current study uses the Technology Acceptance Model (TAM), a well-known theory for explaining individuals' technology behaviors (Davis, 1989), as well as personal characteristics such as learning strategies (Marton & Säljö, 1976a, 1976b), cognitive appraisal (Lazarus & Folkman, 1984), Kuhlthau's model of information seeking (1991) and usability principles as theoretical bases from which we can predict factors that may influence students adopting MOOCs in their learning process, as well as describe their feelings during the learning process. The research questions of this study are:

(a) To what extent does the TAM explain students' attitudes towards future use of MOOCs?
(b) How do personal characteristics such as learning strategies and cognitive appraisal influence students' attitudes towards future use of MOOCs?
(c) Do demographic variables such as gender and education affect students' attitudes towards future use of MOOCs?
(d) To what extent does Kuhlthau's model of information seeking explains students' emotional attitudes when studying courses offered on the MOOC platform?

Theoretical Background

Technology Acceptance Model

Adopting information technology has been the focus of many studies in information system research (Burton-Jones & Hubona, 2005). The goal of technology acceptance theory is to understand the factors that influence adoption of new technologies throughout a social system (Barnes & Huff, 2003), assuming that people can choose whether or not to adopt an innovation (Gefen & Straub, 1997). The current research addresses the Technology Acceptance Model (TAM), which was developed by Davis (1989). The TAM is built on the Theory of Reasoned Action (TRA) that has its roots in social psychology. According to TRA, behavior is explained by people's behavioral intentions, attitudes, subjective norms, and beliefs (Fishbein & Ajzen, 1975). Davis (1989) has introduced the TAM to study user acceptance of information systems. He suggests that the process of accepting information systems includes two major components: perceived usefulness (PU) and perceived ease of use (PEOU). PU addresses the notion that adopting a certain technology or system will contribute to a better performance. PEOU relates to the belief that there would be no difficulties in using the new technology or system (Davis, 1989).

Through the years, TAM was examined by researchers in various areas, including e-learning. Al-Busaidi (2013) investigated learners' adoption of blended learning, finding that personal innovativeness and PU of the Learning Management System (LMS) are significant to learners' intention to engage in full e-learning. Another study that examined e-learning system usage in the university context revealed that PU and PEOU influence students' perceptions that the e-learning system will assist them in the learning process and in building a social community (Islam, 2013). In a recent survey (Cheung & Vogel, 2013) focused on an extension of the TAM for e-learning and found that the traditional components of the TAM are the major factors that influence the adoption of Google Applications for collaborative learning. Recently Xu (2015) noted that intentions to use MOOC were associated with perceived usefulness (PU) of the course and not with its ease of use (PEOU). In light of the above, the first two research hypotheses will be:

> H1: PU will be positively associated with future intended use of MOOCs.
>
> H2: PEOU will be positively associated with future intended use of MOOCs.

Learning Strategies

The second variable that might affect IS students' attitudes towards MOOCs is learning strategies. Individual differences in intentions, motives and processing strategies used by students in different learning environments were explored in previous studies (e.g., Prat-Sala & Redford, 2010). The current paper explores the deep learning versus the surface learning approach; terms that are based on the early work of Marton and Säljö (1976a, 1976b), who used qualitative analysis to examine differences in students' approaches towards written texts. In general, deep learners tend to explore the topic to its greatest extent (von Stumm & Furnham, 2012). A deep learning strategy is usually followed by success, high quality learning outcomes (Trigwell & Prosser, 1991), elaborating ideas, problem solving, critical thinking and self-management (Biggs, 1987; Kember, Charlesworth, Dabies, Mackay, & Scott, 1997). It is associated with linking and integrating one concept with another (Biggs, 1987), as well as with students' intention to fully understand the text, concentrate on different aspects of the material, and seek relevant links between the new material, everyday life, and personal experiences. Deep learners tend to seek for their 'inner self' through the learning process (Biggs, 1993; Entwistle, 1977).

Contrarily, surface learners learn only important and essential facts, applying minimum study efforts (Biggs, 1987). A surface learning approach is associated with students who study only superficial details (Prat-Sala & Redford, 2010). They are concerned with the time needed to accomplish the learning task; therefore, they try to choose the quickest way to accomplish their learning assignment, without asking further questions and without fully understanding the text meanings. Surface learners usually memorize facts, thus, meta-cognitive skills are mostly not involved in their learning process (Biggs, 1993).

It was shown that that a deep learning strategy leads to better grades, while a surface learning strategy is usually followed by lower grades (Duff, 2004; Ellis, Goodyear, Brillant, & Prosser, 2008; Ellis, Goodyear, Calvo, & Prosser, 2008). A previous study that focused on IS students showed that those students who exercise deep learning strategies have higher motivations towards learning about Web 2.0 applications and environments, and make greater use of them than do surface learners (Aharony, 2009). Yang and Tsai (2010) showed that deep learners were able to improve their achievements more in a multi-stage online peer assessment activity than their surface counterparts. Assuming that deep and surface learning strategies may predict students' MOOC future use, the hypotheses of this study are:

> H3: Deep learning strategy will be positively associated with future intended use of MOOCs.
>
> H4: Surface learning strategy will be negatively associated with future intended use of MOOCs.

Cognitive appraisal: Threat versus challenge

Cognitive appraisals of threat and challenge refer to "dispositions to appraise ongoing relationships with the environment consistently in one way or another" (Lazarus, 1991, p. 138). Cognitive appraisal addresses the person's evaluation of events for his or her well-being (Lazarus, 1993). Lazarus and Folkman (1984) propose that when someone confronts a situation that threatens an important action, he or she undergoes a specific cognitive process. The person evaluates the demands of the environment ("primary appraisal"), and then chooses one of his/her resources to cope with the situation ("secondary appraisal"). A challenge appraisal indicates that the demands of the stressful situation can be overcome, and that the individual assumes that there is a potential for gain or benefit (Lazarus, Kanner, & Folkman, 1980; Park & Folkman, 1997). Lazarus suggests (1991) that the emotions associated with challenge are joy, excitement and happiness. In addition, these persons consider the possibility for success, social rewards, mastery, learning, and personal growth (Lazarus, 1991; Lazarus & Folkman, 1984). Contrarily, threat occurs when the individual estimates that resources do not meet situational demands. Further threat is accompanied by potential danger to the person's self-esteem and self-being (Lazarus, 1991; Lazarus & Folkman, 1984). Studies reveal that people who are in a threat state, experience anxiety in social or stressful situations, such as tests or sports and anticipate failure or negative evaluations (Rapee & Heimberg, 1997; Wilson & Eklund, 1998). Researchers suggest that challenge and threat are context bound and take place only in motivated performance situations such as delivering a speech, exams, or sport competitions (Blascovich, 2008; Blascovich, Mendes, Hunter, & Lickel, 2000). Moreover, different studies show that a challenge state helps performance while a threat state slows it down (Mendes, Blascovich, Hunter, Lickel, & Jost, 2007; Seery, Weisbuch, Hetenyi, & Blascovich, 2010). Other studies that were conducted in the information science environment revealed that the more challenged information professionals are, the higher their behavioral intention to use e-books (Aharony, 2014a), and the higher is their Web 2.0 use (Aharony,2009). Based on the literature review, H5 and H6 are developed:

> H5: High level of challenge will be positively associated with future intended use of MOOCs.
>
> H6: High level of threat will be negatively associated with future intended use of MOOCs.

Kuhlthau's model of the information seeking process

Kuhlthau's model (1991) of the information seeking process emphasizes the emotional aspects of the information seeking process. Initially the individual feels uncertain when she understands that she lacks knowledge. This feeling of uncertainty is replaced by optimism when the user manages to select the topic or approach to be pursued. During the search process the individual experiences an "affective roller coaster", when uncertainty, confusion, clarity, confidence, satisfaction and/or dissatisfaction accompany the different phases of the search process.

In the current study our users, similarly to the high school students observed by Kuhlthau gathering information for their projects, experienced mood changes during the learning process.

Usability

Usability is a major concept of human computer interaction (HCI) (de Lera, Fernandez, & Valverde, 2010; Preece, Rogers, & Sharp, 2002; Rozanski & Haake, 2003). There are several definitions to usability. According to Berns (2004), usability is "the extent to which a product can be used by specific users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (p.21). Nielsen (1993) proposes that usability refers to interface characteristics that are easy to learn, remember, and that are pleasant to use, efficient and generate the least errors. Nokelainen (2006) expanded Nielsen's definition and included pedagogical aspects in it, suggesting that usability aims at supporting the learning process. Various researchers found that usability is a main factor in adopting LMS for students as well as for instructors (Lewis et al., 2005; Mastoras, Fotaris, Politis, & Manitsaris, 2005; de Porto Alegre Muniz & de Moraes, 2012; Pretorius & van Biljon, 2010). The current study will examine students' opinions about MOOCs' usability.

Methodology

Data Collection

This study was conducted in Israel during the first semester of the 2014 academic year. The students study in the Library and Information Science Department, at Bar-ilan University. There are several platforms of MOOCs: Coursera, edX, and Udacity. In the present study, students who participated in the Introduction to Information Science course were requested to sign up to the Human Computer Interaction (HCI) course on Coursera taught by Scott Klemmer from UC San Diego (see https://www.coursera.org/course/hciucsd). Courses on Coursera are of the xMOOC type (Siemens, 2013). This was a nine week long course, but the students had to take part only in the first four weeks of the course. In the first four weeks basics, the history of HCI, data collection methods, prototyping and heuristic evaluation were discussed. During these four weeks the students had to answer one multiple-choice and one peer-graded assignment and had to participate in the peer-grading process. The content of the first four weeks of the course were part of the offline course requirements. A short review of the major points covered in the online course was also given in the offline course.

The students were required to keep study diaries and answer the following guiding questions each week:

- What is your opinion on the course platform? Discuss pluses and minuses.
- What is your opinion about your learning process? Please relate both to cognitive and affective aspects. Discuss plusses and minuses.
- What is your opinion about the content of the course and the way it is being taught? Discuss plusses and minuses.

They were also asked about their opinions on the quiz, the assignment and on the peer-grading process (both about the way they rated the works of others and about the grade and comments they received from others). Finally, after four weeks of taking part in the MOOC, they were asked to compare this course to other online and offline courses they took and they were asked whether they were interested in taking other MOOCs in the future.

In addition, after four weeks of participating in the MOOC, researchers wanted to have a broader and a more comprehensive perspective about students' perceptions on MOOCs. Hence, students were asked to fill in a questionnaire comprised of: demographic data, a threats and challenges questionnaire, a deep vs surface learning questionnaire and a TAM questionnaire.

Altogether 102 students answered the questionnaire, and 96 of them answered the future use question in the diary. Future use was an open ended question, and was coded by us as: yes, depends and no.

Measures

Qualitative Research

We used open questions to gather information about the process students have undergone while studying with the MOOC. In order to analyze the answers, we used a content analysis. The goal of content analysis is to examine message characteristics in an objective manner by applying consistent criteria rigorously (Neuendorf, 2002). Krippendorff (1980) presents the advantages of content analysis: it is unobtrusive, accepts unstructured material, and is context sensitive. It can also process symbolic forms and cope with large amounts of data. While analyzing the content of the diaries, special emphasis was placed on the affective aspects, usability issues and on their intention to taking MOOCs in the future. The data was collected and analyzed by the two researchers. The initial coding scheme was developed after the analysis of about 10% of data. The final percentage of agreement for all coding decisions was 90%, which suggests that the coding classification used was reliable.

Quantitative Research

We used five questionnaires to gather the following data: personal details, cognitive appraisal, learning strategies, and two MOOC attitude questionnaires. The personal details questionnaire had three statements: gender, education and age.

The cognitive appraisal questionnaire measured students' feelings of threat versus challenge when confronted with new situations. It consisted of 9 statements rated on a 5-point Likert scale (1=strongest disagreement; 5 = strongest agreement). This questionnaire was previously used (Aharony, 2009, Yekutiel, 1990) and consisted of two factors: threat (items 1, 2, 3, 4, 6, 7) and challenge (items 5, 8, 9). Cronbach's Alpha was .91 for the threat factor and .74 for the challenge factor.

The learning strategies questionnaire consisted of 14 statements rated on a 5-point Likert scale (1=strongest disagreement; 5= strongest agreement). This questionnaire, which was also previously validated (Aharony, 2009, 2014b), consists of two factors: deep and surface learning strategies, with seven items for deep learning (items 1, 3, 6, 8, 9, 12, 13); and seven for surface learning (items 2, 4, 5, 7, 10, 11, 14). Cronbach's Alpha coefficients were .78 and .71, respectively.

The first attitude questionnaire addressed MOOCs' perceived usefulness (PU) and was based on Liu, Li, and Carlsson (2010). It was modified for this study and consisted of three statements rated on a 5-point Likert scale (1=strongest disagreement; 5= strongest agreement). The value of Cronbach's Alpha was .83.

The second attitude questionnaire examined MOOCs' perceived ease of use (PEOU) and was also based on Liu, Li, and Carlsson (2010). It was modified for this study and consisted of three statements rated on a 5-point Likert scale (1=strongest disagreement; 5= strongest agreement). The value of Cronbach's Alpha was .82. The questionnaires appear in the Appendix.

Data Analysis

Quantitative Analysis

Of the whole group, 36 (35.29%) respondents were male and 66 (64.70%) were female. Their average age was 28.58; where 59 (57.84%) were Bachelor of Arts (BA) students and 43 (42.15%) were Master of Arts (MA) students. In order to examine whether there are differences between BA and MA students concerning the study variables (cognitive appraisal, learning strategies, attitudes, and future use), a one-way MANOVA was conducted. The MANOVA revealed significant differences between the two groups concerning threat and challenge, *F* (2, 99) =6.22, $p < .01$, $\eta^2 = .12$, and concerning deep and surface learning, *F* (2, 99) =11.73 $p < .001$, $\eta^2 = .19$. Means and standard deviations are presented in Table 1.

Table 1. Means and standard deviations of threat, challenge, deep and surface learning

Measures	BA Students		MA Students			
	M	*SD*	*M*	*SD*	*F(2,99)*	*Eta*^{2}
Threat	2.01	.86	1.54	.73	8.45***	.07
Challenge	2.81	.87	3.27	.82	6.96**	.06
Deep	3.05	.76	3.53	.58	11.82***	.10
Surface	2.27	.61	1.75	.54	19.65***	.16

** p < .01; *** p < .001

Table 1 shows that the ANOVA performed on each measure separately revealed significant differences between the two groups concerning the four measures: threat and challenge, and learning strategies. It seems that BA students are more threatened than MA students of MOOC, and that MA students are more challenged than BA students participating in a MOOC. Further, MA students are deeper learners than BA students who are more surface learners. A further one-way MANOVA that focused on the TAM variables (PEOU, and PU) and MOOC future use, revealed a significant difference between the two groups concerning PU, *F* (3, 92) =*2.69, p* = .05, $\eta^2 = .08$. The ANOVA performed on each measure separately showed significant differences between the two group concerning PU, *F* (1, 94) =*7.11, p* < .01, $\eta^2 = .07$. It seems that MA students perceive MOOC as more useful, *M* = 3.64, *SD* = .88, than BA students, *M* = 3.14, *SD* = .92 (the variables were assessed on a scale of 1 to 5).

In order to examine the relationship between the demographic variables, PU, PEOU, learning strategies, cognitive appraisal, and MOOC future use, Pearson correlations were computed, which are given in Table 2.

Table 2. Pearson correlations between demographic variables. PU, PEOU, learning strategies, cognitive appraisal, and MOOC future use (N=102)

Measures	Age	Education	PU	PEOU	Deep	Surface	Threat	Challenge
Age								
Education	.66***							
PU	.13	.22*						
PEOU	.13	.14	.50***					
Deep	.31**	.32**	.24*	.19				
Threat	-.24*	-.39***	-.17	.02	-.44***			
Surface	-.23*	-.29	-.50***	-.54***	-.16	.11		
Challenge	.18	.25**	.59***	.33**	.15	.00	-.29**	
Future use	.12	.22*	.38***	.24*	.06	-.04	-.21*	.16

*$p < .05$; ** $p < .01$; ***$p < .001$

Significant positive correlations were found between PU, PEOU, education and future use; therefore, the higher level of PU and PEOU, and the higher students' academic degree, the higher MOOC's future use will be. Further, significant negative correlation was found between threat and future use. In other words, the less threatened students are, the higher their intention to participate in MOOCs in the future will be. Regarding the correlations between the research variables themselves, significant positive correlations were found between age and deep learning strategy, and significant negative correlations were found between age and surface learning strategy, and threat. In other words, the older students are, the more deep learners they are, and the less threatened they are of MOOC. Addressing the education variable, significant positive correlations were found between education and PU, deep learning strategy, and challenge, and significant negative correlation with surface learning strategy. It seems that the more educated students are deeper learners, more challenged and rate higher the usefulness of MOOCs.

We also conducted a hierarchical regression using MOOC future use as a dependent variable. The predictors were entered in five steps: (1) students' education; (2) cognitive appraisal variables (threat versus challenge); (3) learning strategies (deep and surface); (4) attitudes variables (PEOU, PU); and (5) interaction between deep learning strategy X PEOU. The entrance of the four first steps was forced, while the interaction was done according to its contribution to the explained variance of MOOC use. The regression explained 25% of MOOC use. Table 3 presents the standardized and unstandardized coefficients of the hierarchical regression of respondents' MOOC future use.

Table 3. Hierarchical regression coefficients of students' MOOC future use (N=96)

Predictors	B	β	R^2	ΔR^2
1. Education	.31	.19*	.04*	.04*
2. Threat Challenge	-.15 .07	-.15 .07	.03*	.03
3. Deep Surface	-.00 .06	-.00 .04	.07*	.00
4. PEOU PU	.07 .36	.08 .41**	.18*	.11**
5. Deep X PEOU	-.20	-.28**	.25**	.07**

* $p < .05$; ** $p < .01$; *** $p < .001$

The first step introduced the education variable that contributed significantly by adding 4% to the explained variance of MOOC future use. The beta coefficient of the education variable is positive; hence, the more educated respondents are, the higher their intention to use MOOCs. The second step introduced the cognitive appraisal variables (threat versus challenge) of which only threat contributed significantly by adding 3% to the explained variance of MOOC future use. The beta coefficient of threat was negative. In other words, the more threatened students are, the less their MOOC future use will be. The third step introduced learning strategies variables (deep and surface) that did not contribute to the explained variance of MOOC future use. The fourth step added students' perceptions about PEOU and PU that added 11% to the explained variance of MOOC future use. It should be noted that only the PU contributed significantly to the explained variance of MOOC future use. Therefore we may conclude that the more students perceive MOOC as useful, the higher their future intention to use it. As the fifth step, the interaction between deep learning strategy X PEOU was entered which added 7% to the explained variance of MOOC future use. The interaction between deep learning strategy and PEOU is presented in Figure 1.

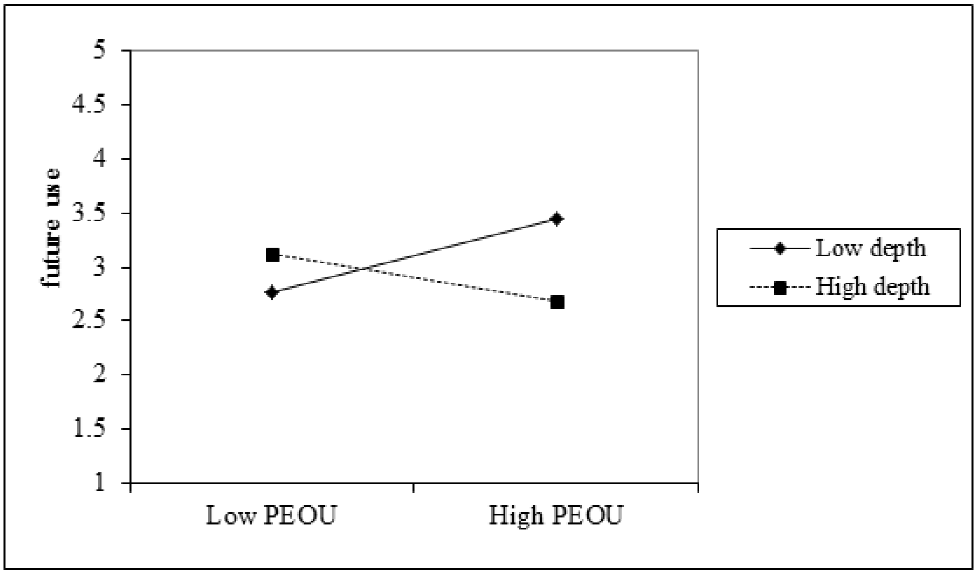


Figure 1. Interaction between deep learning strategy and PEOU

Significant correlation was found between perceived ease of use (PEOU) and MOOC future use among those students who are low in their deep learning strategy, $\beta = .29$, $p < .05$. However, no significant correlation was found between those students who are high in depth learning strategy and MOOC future use, $\beta = -.08$, $p > .05$. Thus, especially among students who are low on deep learning strategies, the higher they perceive MOOC's PEOU, the greater their MOOC future use will be.

Qualitative Analysis

The second section of the discussion will present the qualitative analysis that focused on emotional aspects while studying with the MOOC and on the students' opinions about MOOCs' usability. Based on Kuhlthau's model (1991), we found that students have undergone emotional changes over time. Some students wrote in their diaries that at the beginning of the course they felt uncertainty, confusion and did not know how to handle the new situation. A few quotations are presented below:

- "At the beginning of the course I felt confused"
- "At the beginning of the course I was excited and a bit scared"
- At first I felt uncertain about the course and its goals"
- "I felt stressed at the beginning"
- "I had the feeling of disorientation…"

Another dimension of uneasiness is presented by a student:

- "I was scared of the peer review process"

However, in accordance with Kuhlthau's model (1991), it seems that during the learning process the feelings of uncertainty diminished and were replaced with feelings of confidence. The following statements express this shift of feelings:

- "I got used to the platform, and I feel much better"
- "I felt uncertain at the beginning, but during the process I felt much more confident"
- "There is a process of adoption"
- "Over time, I became more relaxed"

Students wrote that one cause to their feelings of uncertainty was the fact that the course was given in English, a foreign language to the Israeli students. Some of them wrote:

- "I had difficulties with the language"
- "I was frustrated because the course was in English"

However, we can see that again according to Kuhlthau's model (1991), this feeling has changed during the course and students' feelings got better:

- "During the course the level of English has improved"
- "I am proud that I have overcome the language difficulties"

Addressing the usability issue, there was not a consensus among the students. Some reported high satisfaction with the course platform while others were not satisfied with it. The following statements express satisfaction with the platform:

- "The interface was friendly and convenient "
- "The platform was very friendly"
- "There were many examples that facilitated the learning process"
- "There were short videos that helped understanding the material"
- "We could repeat and watch the lecture again and again"
- "The questions in the middle of the videos help me concentrate"

On the other hand, those students that were not satisfied with the MOOC stated:

- "There were many technological problems with the course"
- "The examples were not clear"
- "The fact that the course was given in English caused a lot of problems"
- "The questions during the videos distract me"
- "It is difficult and boring to sit alone by the computer and to watch the videos"
- "We lacked interaction with the instructor"
- "The videos were too long, they also got stuck in the middle"

Discussion and Conclusions

The first section of the discussion will be based on the quantitative analysis. The present research explored the extent to which the TAM, personal characteristics such as learning strategies, threat, and challenge, and demographic variables such as education, explain students' future intentions to use MOOCs in their learning process. By addressing these questions, this article makes a number of theoretical and practical contributions:

- It expands the current research about TAM by examining it within the context of MOOCs, focusing on the perspectives of students.
- It confirms that the TAM, as well as other personal and demographic characteristics, significantly predicts the likelihood of MOOCs adoption. Perceived usefulness contributes greatly to the intended future use of MOOCs.
- It highlights the importance of individual characteristics when considering technology acceptance. Instructors should be aware of individual differences in technology use and acceptance, as these factors may explain why some students adopt technological innovations in their study environments while others do not.

Addressing the study hypotheses, three of the six hypotheses were accepted. The first two (H1 and H2) support the TAM, suggesting that the more students perceive MOOCs as useful and easy to use, the higher their behavioral intention to enroll in MOOCs in the future. Pointing to the course's usefulness students say: "there are many examples in the course", "we can study anywhere", "it improves our English", "we can watch the lecture again", "we don't spend time as in a conventional class"…When talking about the MOOC's perceived ease of use students mention: "the interface is convenient", "there are examples", "the course is clear", "the site is clear".

Results also suggest that the effect of PU was greater than that of PEOU. This finding is not surprising because previous studies have already shown that PU has a stronger effect on technology acceptance than PEOU (e.g., Aharony, 2014c). Our results indicate that students will use MOOCs if they perceive that such usage is beneficial, will help them to study better, and will improve their learning outcomes. Further, they will use MOOCs if they find them friendly, simple and perceive they would not require a lot of effort. If instructors would like their students to adopt MOOCs, they should present to their students MOOCs' usefulness and ease of use, hoping it will encourage their students to enroll in MOOCs within their curriculum. In addition efforts should be made to increase the usability of MOOCs.

H3 and H4 that focus on learning strategies were not accepted. Results show that neither deep learning strategy nor surface one, were significantly correlated with intended future use of MOOCs. These findings are surprising as we assumed that deep learners will be more motivated to study on a new technological platform, and would like to experience new methods during their learning process. However, an interesting interaction that was revealed in the study showed that, especially among students who were ranked as low in deep learning strategies, the higher they perceive MOOCs' PEOU, the greater their MOOC future use will be. Thus, for those students who are low in deep learning strategy, the perceived ease of use is an important factor in deciding to enroll in a MOOC in the future. This indicates that because they are not high in deep learning, technical variables such as simplicity and friendliness may influence their MOOC future use.

Addressing the two last hypotheses (H5 and H6) that relate to the threat and challenge variables, we see that only H6 was accepted. It was surprising to see that H5 (challenge) was not accepted. However, we see that the more threatened students are the less they will use MOOCs in the future. In other words, the more students perceive the new technological platform that includes a large number of students, and peer assessment as threatening, the less they intend to use MOOCs. This result is comparable with previous studies (Aharony, 2014c; Lazarus, 1991; Lazarus & Folkman, 1984) suggesting that when respondents view situations as threats, they infer there is a potential danger for their well-being. Instructors should emphasize the usefulness and ease of use of MOOCs, thus, reducing the students' threat level. This will hopefully encourage them to try using MOOCs within their curriculum. Perceived ease of use can be influenced by developing improved MOOCs platforms.

Another interesting finding that was revealed in the current study was that the higher students' academic degree, the higher MOOCs' future use will be. In other words, MA students intend to enroll in MOOCs in the future more than BA students. This finding accompanies previous results in the current study, that address the MA students and showed that the more educated students are, the higher they perceive MOOCs usefulness, the deeper learners they are, and the more challenged they are of MOOCs use. As a whole, findings display a difference between MA and BA students, suggesting that MA students are deeper learners, their intention to use MOOCs in the future is greater, they perceive more the usefulness of MOOCs, and feel more challenged participating in MOOCs.

The qualitative analysis revealed mood changes over time, the feeling of uncertainty was replaced by expressions of confidence. Students felt threatened by the fact that the course was in English at the beginning, but they were content to realize that they are able to cope and overcome this difficulty as the course proceeded.

In conclusion, the current study found that perceived usefulness and ease of use have major influence on the intention to enroll in a MOOC. Perceived ease of use can be increased by improving the current MOOCs platforms. In order to achieve this, user studies are needed to understand how the platforms are used and what problems users encounter, thus facilitating students' engagement with MOOCs. Perceived usefulness can also be improved by providing content that suits the students' needs, hence increasing students' perceptions about the content's relevance and usefulness.

Findings also reveal that students have different needs and expectations; for example, some of the students were satisfied with the questions that test understanding in the middle of the videos while others were distracted by these questions. In addition, some preferred to read the transcripts while others preferred watching the videos. Therefore the MOOCs platforms should provide multiple options to accommodate these needs.

This study has some limitations. The first is that, in order to gain a broader perspective, it is recommended that a further study that includes a larger number of students who study via the MOOCs be conducted. This study concentrated on a single course, and possible the subject matter of the course and the instructor affects the attitudes. Finally, since the current study focused only on Israeli students, we suggest that in order to have an international perspective towards MOOCs assimilation; the study should be carried out in other countries as well.

References

Aharony, N. (2009). The influence of LIS students' personality characteristics on their perceptions towards Web 2.0 use**.** *Journal of Librarianship and Information Science, 41*(4), 227-241.

Aharony, N. (2014a). The effect of personal and situational factors on LIS students' and professionals' intentions to use e-books. *Library & Information Science Research*, *36*(2), 106-113. doi:10.1016/j.lisr.2014.01.001

Aharony, N. (2014b). Library and information science students' perceptions of m-learning. *Journal of Librarianship and Information Science, 46*(1), 48–61.

Aharony, N. (2014c). Factors affecting the adoption of e-books by information professionals. *Journal of Librarianship and Information Science*. doi: 10.1177/0961000614532120

Alraimi, K. M., Zo, H., & Ciganek, A. P. (2015). Understanding the MOOCs continuance: The role of openness and reputation. *Computers & Education,* 80, 28-38.

Al-Busaidi, K. A. (2013). An empirical investigation linking learners' adoption of blended learning to their intention of full e-learning. *Behaviour & IT 32*(11), 1168-1176.

Barnes, S. J., & Huff, S. L. (2003). Rising sun: iMode and the wireless Internet. *Communications of the ACM*, *46*(11), 78-84.

Belanger, Y., & Thornton, J. (2013). *Bioelectricity: A quantitative approach. Duke University's first MOOC.* Retrieved from http://dukespace.lib.duke.edu/dspace/bitstream/handle/10161/6216/Duke_Bioelectricity_MOOC_Fall2012.pdf

Berns, T. (2004). Usability and user-centered design, a necessity for efficient e-learning! *International Journal of the Computer, the Internet and Management, 12*(2), 20-25.

Biggs, J. (1987). *The Study Process Questionnaire (SPQ): Manual*. Hawthorn, Victoria: Australian Council for Educational Research.

Biggs, J. (1993). What do inventories of students' learning process really measure? A theoretical review and clarification, *British Journal of Educational Psychology, 63*, 3-19.

Blascovich, J. (2008). Challenge and threat. In A. J. Elliott (Ed.), *Handbook of approach and avoidance motivation* (pp. 431-445). New York, NY: Psychology Press.

Blascovich, J., Mendes, W. B., Hunter, S. B. & Lickel, B. (2000). The social psychology of stigma. In T. Heatherton, R. Kleck, & J. G. Hull (Eds.), *Stigma, threat, and social interactions*. New York: Guilford Publications, Inc.

Burton-Jones, A., & Hubona, G. S. (2005). Individual differences and usage behavior: Revisiting a Technology Acceptance Model assumption. *ACM SIGMIS Database*, *36*(2), 58-77.

Carolan, S., & Magnin, M. (2013). Le MOOC et la motivation. Paper presented at *EIAH2013*. Retrieved from http://ateliermooceiah2013.files.wordpress.com/2013/05/carolan.pdf

Christensen, G., Steinmetz, A., Alcorn, B., Bennett, A., Woods, D., & Emanuel, E. (2013). *The MOOC phenomenon: Who takes MOOC and why?* Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2350964

Cheung, R., & Vogel, D. (2013). Predicting user acceptance of collaborative technologies: An extension of the technology acceptance model for e-learning. *Computers and Education, 63,* 160-175.

Daradoumis, T., Bassi, R., Xhafa, F., & Caballe, S. (2013). A review on massive e-learning (MOOC) design, delivery and assessment. *Eighth International Conference on P2P, Parallel, Grid, Cloud, and Internet Computing*. doi:10.1109/3PGCIC. 2013.37

Davis, F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-339.

de Lera, E., Fernandez, C., & Valverde, L. (2010). The emotional gap in virtual online environments. In Z. Abas, I. Jung, & J. Luca (Eds.), *Proceedings of Global Learn Asia Pacific 2010* (pp. 67-70). AACE.

de Porto Alegre Muniz, M. I., & de Moraes, A. (2012). Usability issues in learning management systems (LMS). *Work 41,* 832-837. doi: 10.3233/WOR-2012-0250-832

Duff, A. (2004). The role of cognitive learning styles in accounting education. *Journal of Accounting Education, 22,* 29-52.

Ellis, R. A., Goodyear, P., Brillant, M., & Prosser, M. (2008). Student experiences in problem based learning in pharmacy: Conceptions of learning, approaches to learning and the integration of face to face and on- line activities. *Advances in Health Science Education: Theory and Practice, 13*(5)*,* 675-692.

Ellis, R. A., Goodyear, P., Calvo, R. A., & Prosser, M. (2008). Engineering students' conceptions of and approaches to learning through discussions in face-to-face and online contexts. *Learning and Instruction, 18*(3), 267-282.

Entwistle, N. J. (1977). Strategies of learning and studying: Recent research findings. *British Journal of Educational Psychology, 25*(3), 225-237.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.

Gefen, D., & Straub, D.W. (1997). Gender difference in the perception and use of e-mail: An extension to the Technology Acceptance Model. *MIS Quarterly, 21*(4), 389-400.

Glance, D., Forsey, M., & Riley, M. (2012). The pedagogical foundations of massive open online courses. *First Monday Journal.* doi:10.5210/fm.v18i5.4350

Grover, S., Franz, P.E., Schneider, E. & Pea, R.D. (2013). The MOOC as distributed intelligence: Dimensions of a framework for design & evaluation of MOOCs. *Proceedings of the 10th Annual International Conference on Computer Supported Collaborative Learning (CSCL)* 2013, Madison, WI.

Islam, N. A. K. M. (2013). Investigating e-learning system usage outcomes in the university context. *Computers and Education, 69,* 387-399.

Joseph, M. A. I., & Nath, M. B. (2013). *Integration of massive open online education (MOOC) system with in-classroom interaction and assessment and accreditation: An extensive report from a pilot study*. Paper presented at Worldcomp 2013, July 22-25, Las Vegas, Nevada. Retrieved from http://weblidi.info.unlp.edu.ar/WorldComp2013-Mirror/p2013/EEE3547.pdf

Kember, D., Charlesworth, M., Dabies, S., Mackay, J., & Scott, V. (1997). Evaluating the effectiveness of educational innovations: Using the SPQ to show that meaningful learning occurs. *Studies in Educational Evaluation, 23*(2), 141-157.

Krippendorff, K. (1980). *Content analysis: An introduction to its methodology*. Beverly Hills, CA: Sage Publications.

Kuhlthau, C. (1991). Inside the search process: Information seeking from the user's perspective. *Journal of the American Society for Information Science, 45*(2), 361-371.

Lazarus, R. S. (1991). *Emotion and adaptation.* New York: Oxford University Press.

Lazarus, R. S. (1993). Coping theory and research: Past, present and future. *Psychosomatic Medicine, 55,* 234-247.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal and coping*. New York, NY: Springer.

Lazarus, R. S., Kanner, A. D., & Folkman, S. (1980). Emotions: A cognitive-phenomenological analysis. In R. Plutchik & H. Kellerman (Eds.), *Emotion: Theory, research and experience* (pp. 189–217). New York: Faculty Press.

Lewis, B. A., MacEntee, V. M., DeLaCruz, S., Englander, C., Jeffrey, T., Takach, E., … Woodall, J. (2005). Learning management system comparison. In *Proceedings of the 2005 Informing Science and IT Education Joint Conference*: Flagstaff, AZ, USA, June 16-19. Santa Rosa, California: Informing Science Press. http://www85.homepage.villanova.edu/timothy.ay/DIT2160/LMS/P03f55Lewis.pdf

Liu, Y., Li, H., & Carlsson, C. (2010). Factors driving the adoption of m-learning: An empirical study. *Computers & Education*, *55*(3), 1211-1219.

Marton, F., & Säljö, R. (1976a). On qualitative differences in learning: 1-outcome and process. *British Journal of Educational Psychology, 46*, 4-11.

Marton, F., & Säljö, R. (1976b). On qualitative differences in learning: 2-outcome as a function of the learner's conception of the task. *British Journal of Educational Psychology, 46*, 115-127.

Mastoras, T., Fotaris, P., Politis, A., & Manitsaris, A. (2005). Designing simplicity: Usability perspectives on learning management systems. *WSEAS Transactions on Information Science and Applications, 2* (10), 1731-1738.

Mendes, W. B., Blascovich, J., Hunter, S. B., Lickel, B., & Jost, J. T. (2007). Threatened by the unexpected: Physiological responses during social interactions with expectancy-violating partners. *Journal of Personality and Social Psychology, 92*, 698-716.

Miguel, J., Caballe, S., & Proeto, J. (2013). Providing information security to MOOC: Towards affecting student authentication. *5th International Conference on Intelligent Networking and Collaborative Systems*. doi: 10.1109. INCoS.2013.52

Nan, L., Himanshu, V., Afroditi, S., Guillaume, Z., Jan, B., & Dillenbourg, P. (2014). Watching MOOCs together: Investigating co-located MOOC study groups. *Distance Education, 35*(2), 217-233, doi: 10.1080/01587919.2014.917708

Neuendorf, K. (2002). *The content analysis guidebook*. Thousand Oaks, CA: Sage.

Nielsen, J. (1993). *Usability engineering.* Massachusetts: Academic Press

Nokelainen, P. (2006). An empirical assessment of pedagogical usability criteria for digital learning material with elementary school students. *Educational Technology & Society*, *9*(2), 178-197.

Pappano, L. (2012). The year of the MOOC. *The New York Times.* Retrieved from http://www.nytimes.com/2012/11/04/education/edlife/massive-open-online-courses-are-multiplying-at-a-rapid-pace.html?pagewanted=all&_r=0

Park, C. L., & Folkman, S. (1997). The role of meaning in the context of stress and coping. *General Review of Psychology, 2,* 115–144.

Prat-Sala, M., & Redford, P. (2010). The interplay between motivation, self-efficacy and approaches to studying. *British Journal of Educational Psychology, 80*(2), 283-305.

Preece, J., Rogers, Y., & Sharp, H. (2002). *Interaction design: Beyond human-computer interaction*. Hoboken, NJ: John Wiley & Sons.

Pretorius, M., & van Biljon, J. (2010). Learning management systems: ICT skills, usability and learnability, *Interactive Technology and Smart Education*, *7*(1), 30-43.

Rapee, R. M., & Heimberg, R. G. (1997). A cognitive-behavioral model of anxiety in social phobia. *Behaviour Research and Therapy, 35*(8), 741-756.

Rozanski, E. P., & Haake, A. R. (2003). *Curriculum and content: The many facets of HCI.* Paper presented at the 4th Conference on Information Technology Curriculum on Information Technology Education, Lafayette, IN.

Seery, M. D., Weisbuch, M., Hetenyi, M. A., & Blascovich, J. (2010). Cardiovascular measures independently predict performance in a university course. *Psychophysiology, 47*, 535-539.

Siemens, G. (2013). Massive open online courses: Innovation in education? *Open Educational Resources: Innovation, Research and Practice*, *5*, 5-15.

Trigwell, K., & Prosser, M. (1991). Relating approaches to study and quality of learning outcomes at the course level. *British Journal of Educational Psychology, 61,* 265-275.

University of Pennsylvania Graduate School of Education, Press Room. (2013, December 9). *Penn GSE study shows MOOCs have relatively few active users, with only a few persisting to course end.* Retrieved from http://www.gse.upenn.edu/pressroom/press-releases/2013/12/penn-gse-study-shows-moocs-have-relatively-few-active-users-only-few-persisti

Von Stumm, S., & Furnham, A. F. (2012). Learning approaches: Associations with typical intellectual engagement, intelligence and the Big Five. *Personality and Individual Differences*, *53*(5), 720-723.

Wilson, P., & Eklund, R. C. (1998). The relationship between competitive anxiety and self-presentational concerns. *Journal of Sport and Exercise Psychology, 20,* 81-97.

Xu, F. (2015). Research of the MOOC study behaviour influencing factors. *Proceedings of International Conference on Advanced Information and Communication Technology for Education* (pp. 18-22). Atlantis Press, Amsterdam, Netherlands, Atlantis Press.

Yang, Y., & Tsai, C. (2010). Conceptions of and approaches to learning through online peer assessment. *Learning and Instruction, 20,* 72-83.

Yekutiel, S. (1990). *Fathers’ and mothers’ confrontation with the transition of parenthood*. Unpublished Master’s thesis, Bar-Ilan University.

Zhou, M. (2016). Chinese university students’ acceptance of MOOCs: A self-determination perspective. *Computers & Education, 92-93,* 194-203.

Appendix: MOOC Questionnaire

1. Personal Details

1. Male / Female
2. Age:
3. Education:

2. Perceived Usefulness (PU) Questionnaire

Below are statements concerning your attitudes towards MOOCs. Please mark with X the column which describes your accordance with the following statements (1=strongly disagree, 5=strongly agree).

Statement	1	2	3	4	5
1. Using MOOCS will help me in the long run					
2. I believe using MOOCs will improve the learning process					
3. Using MOOS will contribute to my personal success in the future					

Perceived Ease of Use (PEOU) Questionnaire

Below are statements concerning your attitudes towards MOOCs. Please mark with X the column which describes your accordance with the following statements (1=strongly disagree, 5=strongly agree).

Statement	1	2	3	4	5
1. It would be easy for me to become skillful at MOOCs					
2. I think that using MOOCs is very simple					
3. I think that generally MOOCs use is simple					

3. Learning Strategies

Listed below are several statements regarding one's general beliefs and attitudes towards the learning process. Please indicate the degree to which you agree or disagree with each statement by marking X the appropriate column of the scale (1=strongly disagree, 5=strongly agree).

Statement	1	2	3	4	5
1. I find that studies cause me a great satisfaction					
2. I would like to pass the course with minimal learning					
3. I find that most of the learning subjects are interesting and I am ready to devote a lot of time outside class to enrich my knowledge					
4. I don't find any course interesting, thus I do the minimum I can					
5. I learn things by heart, even if I do not understand them					
6. I compare the learning process to listening to a good concert or to enjoying a good film					
7. I find it easier to learn by heart and not to try to understand the whole issue					
8. I devote a lot of time to learning because I find it very interesting					
9. In my leisure time I look for further information in reference books					
10. I think it is enough to have minimal basic understandings in the material					
11. I think lecturers should understand that students will not learn material which is not going to be included in tests					
12. I usually come to class with some questions, and I expect they will be answered at the end of the lecture					
13. I read all the additional materials suggested by the lecturer					
14. I think the best way to pass the exam is to remember questions that will probably appear in the exam					

4. Cognitive Appraisal Questionnaire: Threat versus Challenge

Below are statements concerning your attitudes towards new situations (adopting MOOC). Please mark with X the column which describes your accordance with the following statements (1= strongly disagree; 5= strongly Agree).

When you think of MOOC	1	2	3	4	5
1.The situation stresses me					
2. The situation seems difficult to me					
3. The situation threatens me					
4. The situation will harm me					
5. You think you can benefit from this situation					
6. The situation makes me angry					
7. This situation causes anxiety					
8 This situation causes certainty					
9. The situation enables me to show my capacity					

Biographies

Noa Aharony is a professor at the Department of Information Science of Bar-Ilan University in Israel. She received her PhD in 2003 from the School of Education at Bar-Ilan University (Israel). She is the head of the Information Science Department at Bar-Ilan University (Israel). Her research interests are in education for library and information science, information literacy, technological innovations and the LIS community, and Web 2.0. Prof. Aharony is a member of the editorial boards of Journal of Science, Online Information Review, and IJELLO.

Judit Bar-Ilan is professor at the Department of Information Science of Bar-Ilan University in Israel. She received her PhD in computer science from the Hebrew University of Jerusalem and started her research in information science in the mid-1990s at the School of Library, Archive and Information Studies of the Hebrew University of Jerusalem. She moved to the Department of Information Science at Bar-Ilan University in 2002. She is a member of the editorial boards of JASIST, Scientometrics, Journal of Informetrics, PLoS ONE, Cybermetrics, and Online Information Review. Her interests include informetrics, information retrieval, Internet research, information behavior and usability.

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Geri, N, Blau, I., Caspi, A., Kalman, Y. M., Silber-Varod, V., & Eshet-Alkalai, Y. (2016). Introduction to the IJELL special series of Chais conference 2016 best papers. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 163-168. Retrieved from http://www.ijello.org/Volume12/IJELLv12p163-168Chais2016Preface.pdf

Introduction to the IJELL Special Series of Chais Conference 2016 Best Papers

Nitza Geri, Ina Blau, Avner Caspi, Yoram M. Kalman, Vered Silber-Varod, and Yoram Eshet-Alkalai

The Open University of Israel, Raanana, Israel

nitzage@openu.ac.il; Inabl@openu.ac.il; avnerca@openu.ac.il; yoramka@openu.ac.il; vereds@openu.ac.il; yorames@openu.ac.il

Abstract

This preface presents the papers included in the eighth issue of the *Interdisciplinary Journal of e-Skills and Lifelong Learning* (IJELL) special series of selected Chais Conference best papers. The Chais Conference for the Study of Innovation and Learning Technologies: Learning in the Technological Era, is organized annually by the Research Center for Innovation in Learning Technologies, The Open University of Israel. The 11th Chais Conference was held at The Open University of Israel, Raanana, Israel, on February 16-17, 2016.

Keywords: learning technologies, e-learning, technology integration in education, diffusion of innovation, human-computer interaction.

Introduction

"Learning in the Technological Era" is a series of annual national research conferences on innovation and learning technologies, initiated in 2006 by the Research Center for Innovation in Learning Technologies (formerly, the Chais Research Center), The Open University of Israel. The purpose of the Chais conference is to promote the community of Israeli researchers in the field of learning technologies and the positioning of the Open University of Israel as a leading organization in the study and implementation of learning technologies. The eleventh Chais Conference for the Study of Innovation and Learning Technologies: Learning in the Technological Era, was held at The Open University of Israel, Raanana, Israel, on February 16-17, 2016.

The special series of selected Chais conference best papers is intended to expand the international impact of the conference by providing enhanced, extended versions of its finest papers to a global audience. The Informing Science Institute (ISI) enables this endeavor by publishing this special series in the *Interdisciplinary Journal of e-Skills and Lifelong Learning* (IJELL, formerly *Interdisciplinary Journal of E-Learning and Learning Objects* (IJELLO)).

In 2015, we celebrated a decade of Chais conferences. Last year's preface, entitled "A decade of Chais conferences: Introduction to the IJELL special series of Chais conference 2015 best papers" (Geri, Blau, Caspi, Kalman, Silber-Varod, & Eshet-Alkalai, 2015), describes the mission and activities of the Research Center for Innovation in Learning Technologies. It explains its synergies with the in-

Editor: Janice Whatley

forming science transdiscipline (Cohen, 1999, 2009; Cohen & Lloyd, 2014), the Informing Science Institute, and IJELL. Geri et al. (2015) also summarize the objectives and themes of the first ten years of the Chais conferences, as well as the first seven issues of the IJELL special series of selected Chais Conference best papers.

This preface launches the next decade of Chais conferences and presents the papers included in the eighth issue of the IJELL special series of selected Chais Conference best papers. This year, 107 papers were submitted for presentation at the eleventh Chais conference. Following a double-blind peer-review process, 39 papers and 39 posters were accepted for presentation at the conference and were included in the proceedings volume of the conference (Eshet-Alkalai, Blau, Caspi, Geri, Kalman, & Silber-Varod, 2016). The Best Student Paper Award, awarded for the fifth time this year, considered 23 student-based research papers accepted for presentation at the Chais conference 2016. Of these, extended versions of five papers out of the seven finalists for the Award are included in this IJELL special series.

Chais Conference 2016 Best Papers

The eighth selection of IJELL Special Series of Chais Conference Best Papers includes eight of the most outstanding Chais conference 2016 papers that have been expanded and edited for publication in IJELL and undergone a full review process by IJELL's Editors and reviewers.

The first paper by Tal Berger-Tikochinski, Michal Zion, and Ornit Spektor-Levy, "Up and down: Trends in students' perceptions about learning in a 1:1 laptop model - A longitudinal study", was the winner of the best student (Tal Berger-Tikochinski) paper award of the Chais conference 2016. Their five-year study, which involved 770 junior high school students, indicated that the level of positive attitudes towards learning with laptops declined over time. However, the attitudes of students who started the program in a later year were more positive than those who began earlier. Longitudinal, multi-year studies are rare in our field, and Berger-Tikochinski et al.'s study provides insights that may support future implementations of laptops, and represents a novel approach for studying technology integration in education.

The next paper, by Adi Friedman, Ina Blau, and Yoram Eshet-Alkalai, "Cheating and feeling honest: Committing and punishing analog versus digital academic dishonesty behaviors in higher education", was a finalist for the best student (Adi Friedman) paper award of the Chais conference 2016. This innovative paper examined the effect of technology use in the context of academic dishonesty. The findings were based on a detailed analysis of 315 protocols of a Disciplinary Committee and revealed intriguing insights on the perceptions of both the cheating students and the members of the Disciplinary Committee.

Ruti Gafni and Idan Nagar's paper, "CAPTCHA: Impact on user experience of users with learning disabilities", was also a finalist for the best student (Idan Nagar) paper award of the Chais conference 2016. The paper addressed the dilemma of cyber security between accessibility and security. Gafni and Nagar examined how five different sorts of CAPTCHA tests affect users with and without learning disabilities. Their findings may help develop CAPTCHA solutions, which are friendlier to humans, do not discriminate against users with learning disabilities, and are still able to detect software attempts to access a website.

Social activities are prevalent online. Yet, it is a challenge to design effective online environments that encourage certain social processes in pedagogical contexts. The design study by Noa Shapira, Hagai Kupermintz, and Yael Kali, entitled "Design principles for promoting intergroup empathy in online environments", was another finalist for the best student (Noa Shapira) paper award of the Chais conference 2016. The authors examined an online community of practice within a professional development program of Civics teachers, which was aimed at promoting empathy among diverse groups. The reasoning behind the program that sponsored the community was that teachers should feel empathy before supporting their students in the process of becoming empathic and that, if online activities are properly designed, empathic processes can occur online. The authors discuss their promising findings and recommend design principles that were found effective in promoting empathy.

Simona Holstein and Anat Cohen's study, "The characteristics of successful MOOCs in Software, Science, and Management fields according to students' perception", was another finalist for the best student (Simona Holstein) paper award of the Chais conference 2016. Massive Open Online Courses (MOOCs) are proliferating in recent years. Holstein and Cohen analyzed thousands of student reviews of xMOOCs, which are instructor-driven online learning environments. The analyses included both quantitative and qualitative methods and found 14 characteristics that contribute to xMOOCs success. Their study emphasizes the importance of listening to the voices of students in order to enable better adaptation of MOOCs.

The paper "Can designing self-representations through creative computing promote an incremental view of intelligence and enhance creativity among at-risk youth?" by Ina Blau and Nurit Benolol, examines the potential of creative computing to increase the self-esteem of youth. Blau and Benolol conducted an experiment that included an intervention, with 117 youth, half of whom were classified as at-risk youth. All the participants received basic training for Scratch programming application and designed artifacts that represented themselves five years in the future. Blau and Benolol's results demonstrate the potential of creative computing combined with an Implicit Theories of Intelligence (ITI) intervention for developing creativity and improving well-being, particularly among at-risk youth.

The next paper, "Perceptions of teacher educators regarding ICT implementation in Israeli colleges of education", by Orit Avidov-Ungar and Alona Forkosh-Baruch, investigated facilitating and hindering factors of Information and Communication Technologies (ICT) implementation in teacher education institutes. This qualitative study addressed three levels of measuring ICT integration: the teacher educators, the students, and the organization (i.e., the college). Data were collected twice, within two-year intervals, allowing the authors to identify trends. The main hindering factors were lack of resources, particularly time and infrastructure, which suggests that policy issues, at both the college level and the national level, have major effect on the success of ICT implementation in education.

The closing paper of this selection is "Analyzing the discourse of Chais Conferences for the Study of Innovation and Learning Technologies via a data-driven approach", by Vered Silber-Varod, Yoram Eshet-Alkalai, and Nitza Geri. The study examined changes over time in the research of learning technologies, as reflected in the corpus of articles published during 2006-2014 in the proceedings of Chais Conferences. The interesting finding, which is also evident in the papers included in the present selection, is the focus of the Chais conferences on the pedagogical aspects of learning technologies, rather than the technological ones.

These eight multifaceted papers represent some of the main themes discussed at the Chais conference 2016. Other main themes presented at the conference, which are not represented in this special selection, include social networks, reading and writing in the digital era, technology integration in science teaching, and assistive technologies for people with special needs.

Conclusion and Acknowledgements

This eighth issue of IJELL's special selection of the Chais conference best papers continues the discussion of current research in learning technologies. The common thread of the research published in the series is the focus on the pedagogical, rather than the technological aspects of learning technologies. The next Chais conference for the study of innovation and learning technologies is scheduled for February 14-15, 2017, at the Open University of Israel campus in Raanana, Israel. We look forward to continuing this fruitful discussion at the conference and the following IJELL issue of the best papers series.

We would like to express our deep gratitude to Janice Whatley, the Editor of the IJELL selection of Chais conference 2016 best papers, for her constructive guidance of the authors and for leading this editorial effort. We thank Gila Kurtz, the former Editor-in-Chief of IJELL, for her enthusiastic support of this endeavor. Special thanks to Eli Cohen and Betty Boyd of the Informing Science Institute for enabling the production of this special series, and to Betty for her publishing work. We thank IJELL's reviewers for their feedback to the authors and praise the contributing authors for their excellent work.

Last, we would like to thank the community of Israeli researchers and practitioners of learning technologies, for their continuing participation in Chais conferences and their collaboration in advancing this important research field.

References

Cohen, E. (1999). Reconceptualizing information systems as a field of the transdiscipline informing science: From ugly duckling to swan, *Journal of Computing and Information Technology, 7*(3), 213-219.

Cohen, E. (2009). A philosophy of informing science. *Informing Science: the International Journal of an Emerging Transdiscipline, 12*, 1-15. Retrieved from https://www.informingscience.org/Publications/425

Cohen, E., & Lloyd, S. (2014). Disciplinary evolution and the rise of the transdiscipline. *Informing Science: the International Journal of an Emerging Transdiscipline, 17,*189-215. Retrieved from https://www.informingscience.org/Publications/2045

Eshet-Alkalai, Y., Blau, I., Caspi, A., Geri, N., Kalman, Y. M., & Silber-Varod, V. (Eds.). (2016). *Proceedings of the 11th Chais Conference for the Study of Innovation and Learning Technologies: Learning in the technological era*. Raanana: The Open University of Israel [partly Hebrew]. Retrieved from http://www.openu.ac.il/innovation/chais2016/2016-book.pdf

Geri, N, Blau, I., Caspi, A., Kalman, Y. M., Silber-Varod, V., & Eshet-Alkalai, Y. (2015). A decade of Chais conferences: Introduction to the IJELL special series of Chais conference 2015 best papers. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 149-157. Retrieved from https://www.informingscience.org/Publications/2331

Biographies

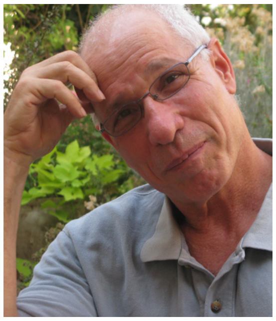
Nitza Geri is an Associate Professor at the Open University of Israel, Department of Management and Economics, and Head of the Research Center for Innovation in Learning Technologies. She holds a B.A. in Accounting and Economics, an M.Sc. in Management Sciences, and a Ph.D. in Technology and Information Systems Management from Tel-Aviv University. Nitza is a CPA (Israel) and prior to her academic career she had over 12 years of business experience. Her research interests and publications focus on various aspects of the value of information and knowledge, as well as adoption, implementation, and continued use of information systems, including strategic information systems, e-business, information economics, attention economy, knowledge management, value creation and the Theory of Constraints, managerial aspects of e-learning systems. Personal site: http://www.openu.ac.il/Personal_sites/nitza-geri.html

Ina Blau is a Senior Lecturer in the Department of Education and Psychology at the Open University of Israel. She holds a Ph.D. in E-Learning and Cyber-Psychology from the University of Haifa, Israel. Her research interests include social aspects of e-communication and e-leadership, integration of innovative technologies in K-12, academia and organizations, mobile learning and interaction, digital literacy skills, online privacy in social networking, and psychological ownership in e-collaboration. Personal site: http://www.openu.ac.il/Personal_sites/ina-blau/

Avner Caspi is a Senior Lecturer at the Open University of Israel, Department of Education & Psychology. He holds a B.A. in Behavioral Sciences (Tel-Aviv Yaffo Academic College), and Ph.D. in Cognitive Psychology (Tel Aviv University). His major research and publications interests focus on social aspects of communication technologies, mainly in the area of learning and instruction. Personal site: http://www.openu.ac.il/Personal_sites/avner-caspi.html

Yoram M Kalman is a Senior Lecturer at The Open University of Israel's department of Management and Economics. He studies the impact of digital technologies on people, organizations and society. His research focuses on aspects of computer-mediated communication (CMC), human-computer interaction (HCI), information systems (IS) and computer supported cooperative work (CSCW). Yoram led the Open University's massive online open courses (MOOC) initiative, and was the founding CEO of the Open University's subsidiary, Online Academe Ltd. Personal site: http://www.kalmans.com.

Vered Silber-Varod is a Research Fellow at The Research Center for Innovation in Learning Technologies, The Open University of Israel, Ra'anana. She received the B.A. in Political Science and French language and literature studies from the Hebrew University of Jerusalem, a M.A. degree with Magna Com Lauda in Hebrew language studies at the department of Hebrew and Semitic languages from Tel Aviv University and the Ph.D. degree from Tel Aviv University. She teaches Modern Hebrew phonology. Previously,, she was a researcher at the ACLP – Afeka Center for Language Processing, Afeka College of Engineering. Her research interests include speech prosody, acoustic phonetics, speech technologies, and quantitative analysis of written and spoken texts. Personal site: http://www.openu.ac.il/en/personalsites/VeredSilberVarod.aspx



Yoram Eshet-Alkalay is a Professor at the Open University of Israel, Department of Education & Psychology. He is Head of the M.A. program in educational technology, and the former Head of the Research Center for Innovation in Learning Technologies in the Open University. He holds a B.A. in Archeology (Hebrew University), M.Sc. in Geology (Hebrew University) and Ph.D. in Earth & Environmental Sciences (City University of NY). For a decade, he was the Head of the Instructional Design Program in the Tel Hai Academic College, and a senior researcher in the Geological Survey of Israel. He has more than 15 years of experience in developing technology-based instructional solutions for educational systems in Israel and the USA. In this capacity, he was involved in the design of hundreds of simulations, data-bases, tutorials and large-scale curriculum integration projects. His major research and publications interests focus on cognitive aspects of working with digital technologies, digital literacy, digital games, digital dishonesty, and design principles of computer-based learning environments. Personal site: http://www.openu.ac.il/Personal_sites/yoram-eshet.html

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Berger-Tikochinski, T., Zion, M., & Spektor-Levy, O. (2016). Up and down: Trends in students' perceptions about learning in a 1:1 laptop model - A longitudinal study. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 169-191. Retrieved from http://www.informingscience.org/Publications/3613

Up and Down: Trends in Students' Perceptions about Learning in a 1:1 Laptop Model – A Longitudinal Study

Tal Berger-Tikochinski, Michal Zion, and Ornit Spektor-Levy
School of Education, Bar-Ilan University, Ramat Gan, Israel

tal.bergertiko@gmail.com; michal.zion@biu.ac.il; ornit.spektor-levy@biu.ac.il

Abstract

This is a five-year study conducted with junior high school students studying in a 1:1-laptop program in order to test the effects of the program on various measures related to the students: their attitudes, motivation, perceived school norms, self-efficacy, and behavioral intention towards learning with laptops, according to the Theory of Planned Behavior (TPB).

These variables were tested at two dimensions: 'duration of learning' – the effect of learning in the program on the same students; 'duration of program in school' – the effect of the program on different students in different school years. Participants (N=770) answered a questionnaire structured according to motivational and TPB variables.

Findings show that attitudes changed over time, but differently for each dimension. For the 'duration of learning', attitudes declined between 7th to 9th grade. Structural equation modeling analysis showed that students' attitudes and self-efficacy explain part of their intention to learn with laptops, therefore ways of maintaining positive attitudes, self-efficacy, and strengthening school norms should be considered. However, for the 'duration of program in school', students' attitudes increased over the years: The attitudes of students who started the program at a later stage were more positive than those who began earlier.

This may indicate that students who experience the program at an advanced stage are better prepared, with more realistic expectations. Findings can assist teacher trainers and policymakers with the implementation of similar programs.

Keywords: one-to-one classrooms, personal laptops, motivation, self-efficacy, Theory of Planned Behavior

Introduction

Technology-rich learning environments are implemented in many countries, with increased investment in technology aimed at reducing the student to computer ratio (Zheng, Arada, Niiya, & Warschauer, 2014). The number of such programs has increased over the past decade, mostly due to the availability of the technology, its affordability, the

Editor: Janice Whatley

An earlier, shorter version of this paper was presented at the Chais conference 2016, in Raanana, Israel, and included in Y. Eshet-Alkalai, I. Blau, A. Caspi, N. Geri, Y. Kalman, & V. Silber-Varod (Eds.), *Proceedings of the 11th Chais Conference for the Study of Innovation and Learning Technologies 2016: Learning in the Technological Era*. Raanana: The Open University of Israel.

increased digital literacy of teachers and students, and rising awareness of the uses of technology integration among educational policy makers (Balanskat, Bannister, Hertz, Sigillò, & Vuorikari, 2013; Islam & Grönlund, 2016; Zheng, Warschauer, Lin, & Chang, 2016).

There are several models available for implementing Information and Communication technology (ICT) in education. The most extensively used model is a classroom equipped with laptop computers in a one-to-one student to computer ratio (also known as 1:1), especially when the students are allowed to take their computer home. This is a ubiquitous learning environment, where each student has access to a digital device when and where they need it; the technology is accessible 24/7 (Hooft, Swan, Cook, & Lin, 2007). This model enables two of the unique features of ICT: the ability for individualized learning and the availability of learning that is not constrained by time or by space (Resnik, 2002). 1:1 environments do not require special preparation prior to using the computer, such as going to the computer lab or bringing a computer cart to class. In these classes, the computer becomes part of the students' daily learning routine, at school and at home. The goals of 1:1 programs include innovative pedagogical change, implementation of 21st century skills among teachers and students, effective use of ICT for learning purposes, improved access to ICT in order to narrow the digital divide, enhanced communication and learning skills, and motivation to learn (Balanskat et al., 2013; Lowther, Inan, Ross, & Strahl, 2012).

1:1 programs are still scarce in Israel. Even though thousands of teachers and students were equipped with laptops over the past decade (Blau & Peled, 2012), the average student to computer ratio in 2011 was 1:12. Almost half of the schools that were studied had a higher ratio of 1:20 (State Comptroller, 2011). The majority of 1:1 programs in Israel rely on the initiative of school principals or local education departments for support. They usually include only one or two classes in school, or use the 1:1 program only in specific subjects, a model known as "Islands of Innovation" (Nahmias, Mioduser, & Forkosh Baruch, 2009). One reason for this scarcity is that the operation of 1:1 programs carries high costs, which include acquisition of computer devices, establishing the necessary technology infrastructure, and teacher training (Penual, 2006). Due to these high costs and the effort required from all parties, it is necessary to have in depth understanding of the educational value of 1:1 programs and the contribution they make to students.

Students' Attitudes, Self-Efficacy, and Motivation in 1:1 Classes

Students report positive attitudes towards learning with a personal laptop computer (Lowther, et al., 2012) and many prefer to learn with a laptop (Zheng et al., 2016). Research on 1:1 laptop classrooms found several positive effects with students. 1:1 computers have been linked to an increase in students' self-efficacy and personal empowerment (Mouza, 2008; Spektor- Levy, Menashe, Berger-Tikochinski, & Doron, 2011). Students also reported student-centered learning (Balanskat et al., 2013) and displayed better information skills than students learning without laptops (Spektor-Levy & Granot-Gilat, 2012). An increase in student computer use (Lowther et al., 2012) and writing (Zheng et al., 2014) was also found.

Overall, students in 1:1 classes report a better learning experience. Islam and Grönlund (2016) and Harper and Milman (2016) reviewed the literature relevant to integration of computers in schools. Both reviews found an increase in students' motivation as a dominant theme in many 1:1 programs. Zheng et al. (2016), who conducted a meta-analysis of research on 1:1 programs, also found that many reported higher motivation and engagement of students. Cavanaugh, Dawson, and Ritzhaupt (2012) found that over 60% of the teachers in 1:1 classes reported increases in enjoyment, motivation, engagement, on-task behavior, and positive school experience amongst their students. Rosen and Beck-hill (2012) noted that learning in a 1:1 program had a positive effect on elementary students' motivation to learn math and reading. Similar findings regarding an increase in students' motivation to learn in a 1:1 learning environment were reported in many additional programs (e.g., Bebell & Kay, 2009, Lowther et al., 2005 in Holcomb, 2009). Students who had been under achievers displayed higher motivation to learn in an ICT environment, perceiving it as different from traditional learning (Reynolds, Treharne, & Tripp, 2003).

Information Literacy in 1:1 Classes

Information literacy is a framework for understanding, searching, evaluating, and using information in such a way that it lays the foundation for lifelong learning. Information literacy includes several skills, such as the ability to find information effectively, critically evaluate information and its sources, and integrate existing and new information (American Library Association, 2000). Despite the importance of these skills, they are often not taught explicitly in the curriculum and most students will acquire them outside of school (Kay, 2010, Perlman, 2010). Research findings suggest that learning in a 1:1 classroom can contribute to students' acquisition of information literacy skills. Spektor-Levy and Granot-Gilat (2012) found that 1:1 laptop students performed significantly better in a computer-based learning task that tested information literacy skills than students from a comparison group who learned without ICT. Zheng et al. (2016) reviewed several examples of 1:1 programs that improved their students' information and technology skills. The meta-analysis they conducted strengthened the finding that writing, editing, and gathering information from the Internet were the most common uses of laptops. Other information literacy skills such as taking notes, searching and organizing information, reading electronic textbooks, finding, analyzing, and sharing information were also prevalent (Crook, Sharma, Wilson, & Muller, 2013; Warschauer, 2007, 2008).

The results of the International Computer and Information Literacy Study (ICILS) conducted in 2013 showed that students who had greater access to a computer tended to demonstrate better information and computer skills (Fraillon, Ainley, Schulz, Friedman, & Gebhardt, 2014), and learning in a 1:1 ubiquitous classroom can provide access to the computer when and where the students need it. However, access to a computer does not guarantee the acquisition of information literacy skills. Even students who use the computer frequently will need to learn the appropriate skills with which to evaluate the information they find.

1:1 classes make it possible to search online sources during the lesson, and this was found to be the most common use of the laptops in class (Dunleavy, Dexter, & Heinecke, 2007). Students reported that in 1:1 learning they can reach online sources and expand their knowledge (Lowther, Ross, & Morrison, 2003). Searching for information as part of the learning process makes this information relevant and increases the possibility that students will remember it and use it in the future (Grimes & Warschauer, 2008). While some of the benefits of information skills implementation can be found in other ICT settings, the comprehensive and intensive nature of a 1:1 program enhances these skills in this environment. This may contribute to students' ability, self-efficacy, and motivation to use ICT skills in the future. Léger and Freiman (2016) conducted a qualitative study in which they interviewed former junior high school students ten years after they participated in a 1:1 laptop program. The former students reported that the main skills they acquired in the 1:1 program were technological resourcefulness that assisted them in adapting easily to new technologies without being intimidated, digital self-efficacy, and an open mind towards technology.

Learning in a 1:1 Laptop Program - Can Sustainability be Achieved?

Studies have shown that 1:1 programs can create a different learning environment, with many advantages. The challenge will be to sustain these changes in order to create ongoing pedagogic processes. However, most of the research on 1:1 programs has been short term (Blackley & Walker, 2015), focusing on the first or second year of the laptop implementation and not on the following years, when the 1:1 programs became part of the daily teaching and learning routine

(Lei, 2010). Results from research that continued after the initial implementation suggest that there are significant changes in teachers, students, and schools, some of which were long-term effects that were not predictable in the first years of implementation (Lei, 2010). In some schools the initial enthusiasm of the teachers and students decreased when the computers became part of the daily routine (Grant & Carolina, 2015; Lowther et al., 2003); a decrease in technology use over time was also reported (Balanskat, et al., 2013). Some schools even canceled 1:1 programs (W. Hu, 2007), due to their high expenses or failure to achieve the anticipated goals (Fleischer, 2012). These findings suggest that when the novelty of the laptops' integration wears off, the advantages found in the first stage of implementation may not necessarily last, but may change over time. Hence the importance of this longitudinal study, which followed a 1:1 laptop program for 5 years.

Technology Acceptance Models - Theory of Planned Behavior

Students may have diverse previous experiences that can influence their views and attitudes towards using technology (Bennett & Maton, 2010). Therefore, it is important to recognize what may affect their perceptions of learning in 1:1 programs. Various theoretical models exist to explain the social and psychological motives that affect technology adaption and acceptance. Each model explains different variables concerning technology adaption. One model is The Technology Acceptance Model (TAM), which identifies two major components in technology acceptance: perceived usefulness and perceived ease of use (Davis, 1989). Another model, the Unified Theory of Acceptance and Use of Technology (UTAUT), explains technology acceptance by performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh, Morris, Davis & Davis, 2003).

The theoretical model chosen for this study is The Theory of Planned Behavior (TPB) (Ajzen, 1985, 1991). TPB was chosen as it is a well-established and robust theoretical model, used as a technology acceptance model in numerous studies, some recently conducted in 1:1 environments (e.g. Courtois et al., 2014; Teo, 2015). According to the TPB model, certain behavior can be explained by behavioral intention, influenced by the attitudes towards the behavior (positive or negative), the subjective norms, which are the social expectations towards this behavior, and the perceived behavioral control, which indicates the amount of control the individuals feel they have over this specific behavior. If one's attitudes towards the behavior are positive, the social norms support it, and one feels one can perform it easily, the behavioral intention will increase, contributing to the performance of the behavior itself. This theory was used to explain technology adaption in educational settings, addressing issues like the perceptions of mobile learning among college students (Cheon, Lee, Crooks, & Song, 2012) or pre-service teachers' intention to use technology (Valtonen et al., 2015). In this study, we will apply the TPB model to a 1:1 laptop program for junior high school students, as described in Figure 1. Through the TPB model, different measures of technology acceptance can be tested: attitudes, norms, self-efficacy, intention to use 1:1 laptops, and behavior - which is measured in this study as using information skills.

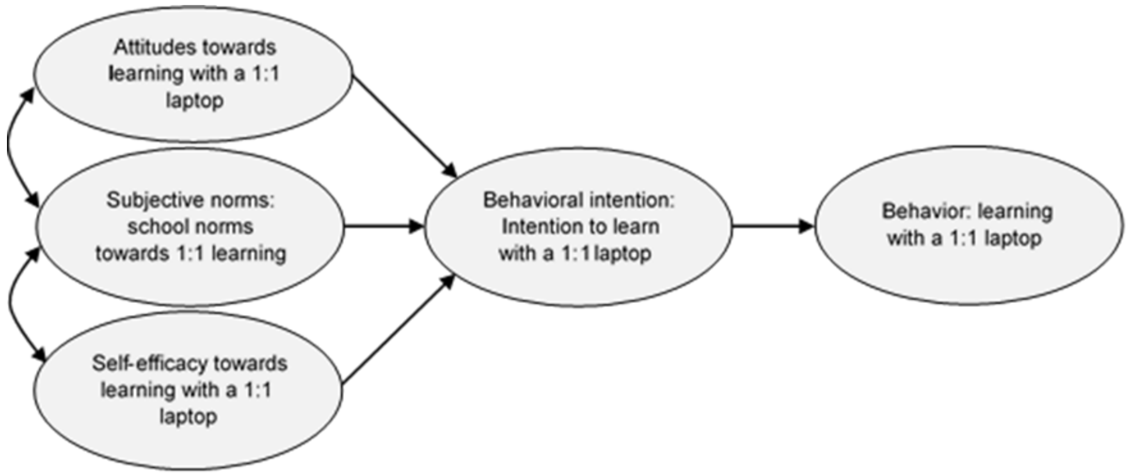


Figure 1: Intention to learn with a 1:1 laptop according to the Theory of Planned Behavior (Ajzen, 1985, 1991)

Research Questions

This paper focuses on the following questions:

1. What are students' attitudes, perceived school norms, self-efficacy, and intention to learn with a 1:1 laptop, in terms of the Theory of Planned Behavior?
2. Are students' attitudes and perceptions towards learning with a 1:1 laptop stable, or do they change over time? How does this stability or change manifest on (a) the 'duration of learning' – the effect of learning in the program on the same students at two time points; (b) the 'duration of program in school' – the effect of the program on different students of the same age group over different school years.

Method

Research Setting

The 1:1 laptop program studied in this research started in 2007 in one small urban town in Israel. The program operates in three schools: two elementary schools in 5th and 6th grade and one junior high school, in 7th through 9th grade. This study began during the third year of the 1:1 laptop program (2009) and lasted as a longitudinal study for 5 years (till 2013). The study examined a wide range of factors among teachers and students. In the paper presented here, we focus on the students and on part of the data that was gathered. The students learnt with a personal laptop for 5 years, from 5th to 9th grade.

The program has several unique aspects: first, the laptop is personal and is part of the daily routine of learning at school and at home. Second, it is operated systematically in all the schools of this urban town in such a way that the students can experience learning with a personal laptop for five consecutive years. In the programs' first years, all the teachers received teacher training and personal support and instruction. Throughout the years, each teacher decided how and when to use the laptop in his or her lessons. The program ends after 9th grade, and the students continue to a high school where no ICT program is implemented.

Research Sample

The research included 770 junior high school students in grades 7-9 (13 to 15 years old) who participated in a 1:1 laptop program between the years 2009 and 2013. Of these students, 48.4% (N=369) were male and 51.6% (N=393) female.

This research followed two student cohorts: 2009-2011 and 2011-2013 (Table 1). Students from both cohorts were from the same junior high school in a small urban town, and from a similar medium- medium-high socio-economic background.

Table 1: Number of students in student cohorts: 2009-2011 and 2011-2013

	7th grade	9th grade
2009-2011	42*	105
2011-2013	115	96

*Since 2009 the cooperation between school and researchers grew and that caused better responds to questionnaires in later years.

Participants were asked to report their daily computer use after school. Differences were found between the two cohorts, for example: 26% of the 2009-2011 cohort reported using the computer for 1-2 hours a day, and 21% used it for 5-6 hours, while 46% of the 2011-2013 cohort reported using the computer after school for 1-2 hours, and 16% used it for 5-6 hours.

Research Tools

The research included a quantitative questionnaire, the Students' Perceived Intentions, Behaviors, and Attitudes – SPIBA, which addressed subjects such as: students' use of the computer at school and at home (e.g., How many hours a day do you use your home computer?), perceived information literacy skills (e.g., "Before I start searching the web, I ask myself questions to figure out what information I'm looking for."; "Before I begin to look for information I carefully choose the keywords I plan to use.") and motivation to learn in a 1:1 program (e.g., "I find great interest when I use a laptop in school."; "I want to get higher grades than other students in 1:1 laptop lessons."). The SPIBA questionnaire is based on a questionnaire validated in Menashe's (2008) study of a 1:1 program and includes 78 items, among them 8 questions regarding students' computer use habits and one open ended question regarding students' attitudes toward continuing to learn in a 1:1 program. The questionnaire also included 70 Likert-style items (some with four levels of agreement and others with seven). The questionnaire includes three parts: motivation, general attitudes towards learning and perceptions towards a 1:1 laptop program.

The first part of the SPIBA questionnaire, the motivation scale, is based on the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich, Smith, Garcia, & McKeachie (1993), adapted to a 1:1 program. The motivation scales from the MSLQ that were adapted and used in the SPIBA questionnaire include:

1. Intrinsic goal orientation: Students' perception of why they are engaged in a certain task. Intrinsic goal orientation refers to the perception of a task as a challenge and a purpose in itself, not a means of achieving other goals.
2. Extrinsic goal orientation: Students' perception of a task as being done for a reward or a grade and not for the learning itself. Students who express high extrinsic orientation can be preoccupied with matters other than learning, such as competition with other classmates.

3. Task value: Students' evaluation of the importance and interest of the task. Students are more likely to be engaged in a task to which they attribute high task value.
4. Control of learning beliefs: Refers to whether the students believe that their efforts to learn will end with a positive result. If students feel their effort is worthwhile and leads to positive results, they are more likely to make this effort in their learning.
5. Self-efficacy for learning and performance: Students' evaluation of their ability to complete a task successfully.

The second part of the SPIBA questionnaire, perceptions towards a 1:1 laptop program, is based on the Theory of Planned Behavior (Figure 1, Table 3), and adapted to learning in a 1:1 laptop program. In this part, we divided the SPIBA questionnaire items into five factors, according to the theory. The factors include attitudes towards learning with a 1:1 laptop; perceived school norms towards 1:1 learning; students' self-efficacy towards learning with a 1:1 computer; intention to learn with a 1:1 computer; behavior - learning with 1:1 computer. The last factor was tested in the context of this study as students' self-report about implementation of information literacy skills.

The third part of the SPIBA questionnaire includes students' attitudes regarding learning in general and not specifically in a 1:1 laptop program. In this part we divided the SPIBA questionnaire items (not included in the previous parts) into three factors (Table 4). The factors include general-learning skills such as reading comprehension or identifying the main ideas in a written text, self-efficacy; students' assessment of their learning, such as assessment of their grades and evaluation of the learning process; students' evaluation of their reflection process or their ability to form their independent opinion.

Two experts and researchers in the field of learning technologies and 1:1 programs validated the factors in each part of the SPIBA questionnaire. When disagreement between experts was found, the experts discussed the issue until full agreement was achieved. In order to measure the internal consistency of the factors, we calculated Cronbach's Alpha for each factor. The reliability measures of the motivational scales, the TPB factors and student attitude factors in the SPIBA questionnaire are presented in Tables 2-4.

The SPIBA questionnaire was administered four times during a five- year period: 2009, 2010, 2011 and 2013. In each administration, students from 7th, 8th and 9th grades from the same junior high school answered the questionnaire using their laptops. This longitudinal five-year research allowed us to collect data, using the SPIBA questionnaire, from two student cohorts (2009-2011 and 2011-2013). We could follow changes in students' attitudes throughout the years 2009-2013 (on year 2012 data was not collected) and we could follow changes in same students at two points in time: the entry to junior high school in seventh grade and the end, in ninth grade.

Table 2: Factors and reliability of the motivational scales of the SPIBA questionnaire according to MSLQ

Motivational Scale according to MSLQ (Pintrich, Smith, Garcia, & McKeachie, 1993)	**Reliability Cronbach's Alpha**
Intrinsic goal orientation	$\alpha = 0.78$
Extrinsic goal orientation	$\alpha = 0.80$
Task value	$\alpha = 0.89$
Control of learning beliefs	$\alpha = 0.69$
Self- efficacy for learning and performance	$\alpha = 0.90$

Table 3: Factors and reliability of the SPIBA questionnaire according to the TPB

Factors according to the TPB (Ajzen, 1985,1991)	**Reliability Cronbach's Alpha**
Attitudes towards learning with a 1:1 laptop	α = 0.88
Subjective norms: school norms towards 1:1 learning (This factor is composed from one item, therefore reliability was not calculated)	-
Self-efficacy towards learning with a 1:1 laptop	α = 0.85
Behavioral intention: Intention to learn with a 1:1 laptop	α = 0.81
Behavior: learning with a 1:1 laptop	α = 0.75

Table 4: Factors and reliability of the SPIBA questionnaire regarding general attitudes towards learning

General attitudes towards learning	**Reliability Cronbach's Alpha**
General learning skills	α = 0.70
Self-efficacy	α = 0.57
Evaluation of the learning process	α = 0.70

Results

This research examined the impact of learning in a 1:1 laptop program on junior high school students' attitudes, motivation, self-efficacy and behavioral intention towards learning with 1:1 personal laptops, as measured by the SPIBA questionnaire based on MSLQ motivation scales, the Theory of Planned Behavior (TPB) scales, and students' general attitudes towards learning. We used these different variables and analyzed them over time, through a longitudinal research design, in order to examine learning in a 1:1 laptop classroom as a complex phenomenon. These variables were tested at two dimensions: 'duration of learning (with a personal laptop)' – the effect of learning in the program on the **same students** at two points in time; 'duration of program in school' – the effect of the program on **different students** of the same age group in different school years.

Change at 'Duration of Learning' Dimension (Same Students at Two Time Points) at the Beginning and End of Junior High School

Findings presented in this section refer to the 'duration of learning' dimension– the effect of learning in the program on the same students at two points in time. For this purpose, we tested two student cohorts (2009-2011 and 2011-2013) at two time points: the beginning of junior high school in seventh grade and the end of junior high in ninth grade. In the data analysis, we used independent sample t-tests, due to the requirement of the Chief Scientist of the Ministry of Education that the student questionnaire be anonymous.

First, we examined the SPIBA motivation scales for these two cohorts (for 2009-2011 see Table 5, for 2011-2013 see Table 6).

Table 5: SPIBA motivation scales, same students 2009-2011

	2009 (N=42)		2011 (N=105)		
	M	*SD*	*M*	*SD*	t-value
Intrinsic goal orientation	5.02	1.16	4.06	1.53	3.69**
Extrinsic goal orientation	5.35	1.28	4.61	1.52	2.77**
Task value	5.27	1.15	4.28	1.57	4.21**
Control of learning beliefs	5.16	.98	4.16	1.48	4.77**
Self- efficacy for learning and performance	5.59	.98	4.98	1.36	3.06**

**p<0.01

Table 6: SPIBA motivation scales, same students 2011-2013

	2011 (N=115)		2013 (N=96)		
	M	*SD*	*M*	*SD*	t-value
Intrinsic goal orientation	4.76	1.27	4.44	1.38	1.73
Extrinsic goal orientation	5.21	1.34	4.79	1.62	2.02*
Task value	5.09	1.38	4.60	1.50	2.45*
Control of learning beliefs	4.77	1.31	4.50	1.39	1.44
Self- efficacy for learning and performance	5.30	1.25	4.95	1.50	1.81

*p<0.05

Findings show a significant decrease in students' attitudes that occurred between grades 7 and 9. In all the SPIBA motivation scales for students from the 2009-2011 cohort, attitudes were higher in 7th grade, the beginning of junior high school, than in 9th grade, its end. For example, students' extrinsic goal orientation declined from mean 5.35 (SD 1.28) to mean 4.61 (1.52) between 2009 and 2011 ($t_{(144)} = 2.77$ $p<0.01$) and from mean 5.21 (SD 1.34) to mean 4.79 (SD 1.62) between 2011 and 2013 ($t_{(205)} = 2.02$ $p<0.05$). The results in some scales of the 2011-2013 cohort are similar: a significant decline in students' attitudes was found for the motivation scales concerning external orientation and task value; hence, students' attitudes were higher in 7th grade compared to their attitudes in 9th grade.

We then checked the perceptions towards learning with personal laptops of students from the same two cohorts (2009-2011 and 2011-2013), according to the TPB, the theoretical model for this research.

Like the SPIBA motivation scales results for these cohorts, students' perceptions towards a 1:1 laptop program also tend to decline between 7th and 9th grade. For example, students' attitudes towards learning with a 1:1 laptop declined from mean 5.16 (SD 1.27) in 2009 to mean 4.15 (SD 1.66) in 2011($t_{(98.84)} = 3.96$ $p<0.01$) and from mean 5.05 (SD 1.47) in 2011 to mean 4.52 (SD 1.59) in 2013 ($t_{(206)} = 2.47$ $p<0.05$). In the 2009-2011 cohort (Table 7), this decrease was significant for attitudes towards learning with a 1:1 laptop, school norms, self-efficacy, and the intention to learn with a 1:1 laptop. For the 2011-2013 cohort (Table 8), a significant decline was found in attitudes, behavioral intention, and self-report of behavior, defined in this research as using information literacy skills.

Table 7: SPIBA-TPB factors, same students 2009-2011

	2009 (N=42)		2011 (N=105)		
	M	*SD*	*M*	*SD*	t-value
Attitudes towards learning with a 1:1 laptop[1]	5.16	1.27	4.15	1.66	3.96**
Self-efficacy towards learning with a 1:1 laptop[1]	5.52	1.07	4.92	1.44	2.46**
School norms towards 1:1 learning[1]	5.24	1.76	4.24	2.06	2.95**
Behavioral intention: intention to learn with a 1:1 laptop[1]	5.38	1.04	4.70	1.46	3.18**
Behavior: learning with a 1:1 laptop[2]	2.75	.63	2.56	.60	1.70

1-7 point scale
2- 4 point scale
**p<0.01

Table 8: SPIBA-TPB factors, same students 2011-2013

	2011 (N=115)		2013 (N=96)		
	M	*SD*	*M*	*SD*	t-value
Attitudes towards learning with a 1:1 laptop[1]	5.05	1.47	4.52	1.59	2.47*
School norms towards 1:1 learning[1]	5.10	1.84	4.63	2.05	1.71
Self-efficacy towards learning with a 1:1 laptop[1]	5.25	1.22	4.90	1.49	1.88
Behavioral intention: Intention to learn with a 1:1 laptop[1]	5.27	1.24	4.82	1.52	2.34*
Behavior: learning with a 1:1 laptop[2]	2.71	.51	2.49	.61	2.93**

1-7 point scale
2- 4 point scale
**p<0.01 *p<0.05

In Tables 9-10 we present the results of students' general attitudes towards their learning, in both cohorts. The figures suggest a decline over time in both cohorts, between 7th and 9th grade. For example, student's perception of their general learning skills declined from mean 3.04 (SD 0.50) in 2011 to mean 2.86 (SD 0.59) in 2013 ($t_{(208)} = 2.36$ $p<0.05$).

Table 9: SPIBA- General attitudes towards learning, same students 2009-2011

	2009 (N=42)		2011 (N=105)		
	M	*SD*	*M*	*SD*	t-value
General learning skills	3.07	.52	2.99	.53	0.83
Self-efficacy	2.68	.59	2.66	.60	0.60
Evaluation of the learning process	2.76	.52	2.64	.64	1.05

Table 10: SPIBA- General attitudes towards learning, same students 2011-2013

	2011 (N=115)		2013 (N=96)		
	M	*SD*	*M*	*SD*	t-value
General learning skills	3.04	.50	2.86	.59	2.36*
Self-efficacy	2.83	.57	2.67	.64	1.95
Evaluation of the learning process	2.71	.58	2.69	.64	0.14

*p<0.05

In order to further examine students' perceptions towards a 1:1 laptop program and the relationship between different variables, we conducted a path analysis (Figures 2 and 3) using Structural Equation Modeling analysis (SEM), superimposed onto the TPB model adapted to learning with a 1:1 laptop (Figure 1). This model includes students' attitudes, school norms, self-efficacy, behavioral intention, and self-report of behavior, measured in this research as implementing information literacy skills. The numbers on the connecting lines of the model represent the β values.

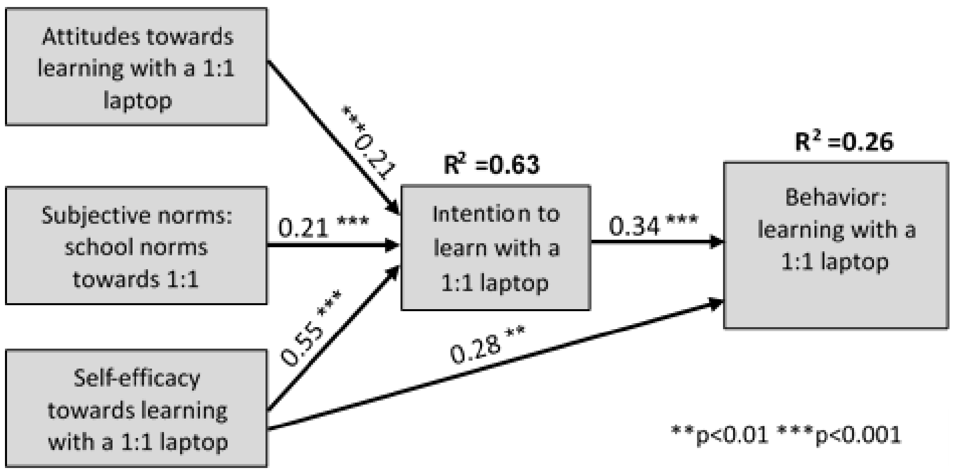


Figure 2: SEM model according to the SPIBA-TPB factors for learning with a 1:1 personal laptop, 2011

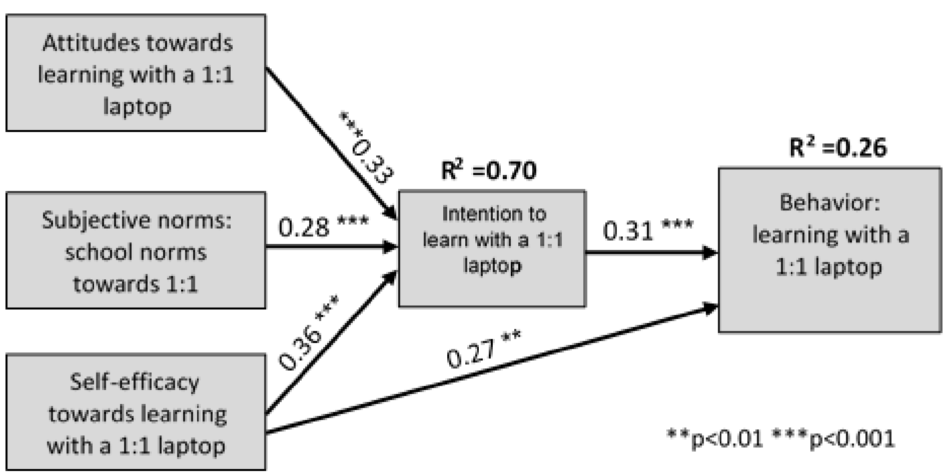


Figure 3: SEM model according to the SPIBA-TPB factors for learning with a 1:1 personal laptop, 2013

In order to assess the fit of the model to the data, we used several goodness-of-fit indices. The first is the chi-square statistic (χ^2), which should be statistically non-significant (Kline, 2011). Other indices include the NFI, CFI, and RMSEA, which were compared to the recommended levels (Cheon et al., 2012; L. T. Hu & Bentler, 1999). The results for both models indicate a good fit. For the 2011 model, the chi-square was found not significant (χ^2=0.246 df=2 p=0.884), NFI=1.000 (recommended> 0.95), CFI=1.000 (recommended > 0.95) and RMSEA=0.000 (recommended< 0.05). For the 2013 model, the chi-square was found not significant (χ^2=1.008 df=2 p=0.604), NFI=0.999 (recommended> 0.95), CFI=1.000 (recommended > 0.95) and RMSEA=0.000 (recommended < 0.05).

We found that the biggest impact on students' intention to learn with a 1:1 laptop is their self-efficacy towards learning with a 1:1 laptop (β=0.55 p<0.001 in 2011 and β=0.36 p< 0.001 in 2013). In the path analysis for 2011 (Figure 2), attitudes towards learning with a 1:1 laptop, school norms and self-efficacy explained 63% of variance (R^2 = 0.63), in the second path analysis, in 2013 (Figure 3) they explained 70% of variance (R^2 = 0.70).

In conclusion, the findings presented in this section indicate that at the 'duration of learning' dimension (the effect of learning in the program - same students at two time points) students' attitudes and perceptions towards different measures of learning in a 1:1 program tend to decrease over time, from the beginning of junior high school at 7th grade to its end in 9th grade. This tendency was found in both student cohorts (2009-2011 and 2011-2013), and was reflected in several measures including most of the motivation scales and students' perceptions towards the 1:1 laptop program according to the TPB, and in some of students' general attitudes towards learning. Findings from the SEM analysis show that students' self-efficacy toward learning with a 1:1 laptop computer has the strongest impact on their intention to learn with a 1:1 laptop.

Change at 'Duration of Program in School' Dimension (Different Students of the Same Age Group at Different School Years) Between the Years 2009 and 2013

In the light of the findings in the previous section, and the decline in students' attitudes over time at the 'duration of learning' dimension, we conducted additional data analysis to examine the attitudes and perceptions of students through another dimension: 'duration of program in school' – the effect of the program on different students of the same age group in different school years.

For this purpose, we examined all students in each year, using a One-way ANOVA. We examined the findings of the questionnaire administered in 2009, 2010, 2011 and 2013. As we did in the first section, we examined the SPIBA motivation scales (Table 11), students' perceptions towards a 1:1 laptop program using the TPB (Table 12) and general attitudes toward learning (Table 13).

When comparing the SPIBA motivation scales at 'duration of program in school' dimension (Table 11) it appears that over the years 2009 to 2013 students' attitudes are similar and often more positive in 2013. For example, students' extrinsic goal orientation increased from mean 4.91 (SD 1.64) in 2009 to mean 5.16 (SD 1.49) in 2013 ($F_{(3,756)}$ = 2.99 p<0.05). This increase was significant for extrinsic goal orientation and control of learning beliefs. Scheffe post hoc tests indicate that the difference is between 2011 and 2013.

Table 11: SPIBA motivation scales, different students 2009-2013 (No data was collected in 2012)

	2009 (N=66)		2010 (N=75)		2011 (N=336)		2013 (N=293)		
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	F
Intrinsic goal orientation	4.54	1.51	4.56	1.55	4.46	1.44	4.71	1.29	1.64
Extrinsic goal orientation	4.91	1.64	4.83	1.70	4.80	1.51	5.16	1.49	2.99*
Task value	4.69	1.62	5.04	1.54	4.72	1.54	4.99	1.47	2.24
Control of learning beliefs	4.78	1.43	4.78	1.29	4.42	1.46	4.77	1.33	4.09**
Self-efficacy for learning and performance	5.07	1.50	5.13	1.51	5.03	1.38	5.18	1.36	0.62

**p<0.01 *p<0.05

Table 12: SPIBA-TPB factors, different students 2009-2013

	2009 (N=66)		2010 (N=75)		2011 (N=336)		2013 (N=293)		
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	F
Attitudes towards learning with a 1:1 laptop[1]	4.61	1.69	4.97	1.63	4.67	1.61	4.92	1.53	1.90
school norms towards 1:1 learning[1]	4.88	2.09	4.82	2.13	4.64	2.06	5.04	1.91	2.07
Self-efficacy towards learning with a 1:1 laptop[1]	5.03	1.51	5.03	1.57	4.98	1.41	5.12	1.39	0.47
Behavioral intention: Intention to learn with a 1:1 laptop[1]	4.89	1.52	4.89	1.64	4.90	1.43	5.14	1.35	1.69
Behavior: learning with a 1:1 laptop[2]	2.65	0.68	2.78	0.67	2.59	0.63	2.66	0.60	1.92

1-7 point scale
2- 4 point scale

The results (Table 12) suggest that at ‘duration of program in school’ dimension students’ perceptions towards some measures of 1:1 laptop program tend to increase over time, between 2009 and 2013. This tendency was not significant.

Table 13: SPIBA- General Attitudes towards learning, different students 2009-2013

	2009 (N=66)		2010 (N=75)		2011 (N=336)		2013 (N=293)		
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	F
General learning skills	2.94	.58	3.01	.62	2.93	.57	3.01	.57	1.22
Self-efficacy	2.63	.61	2.90	.74	2.73	.59	2.83	.57	4.05**
Evaluation of the learning process	2.61	.63	2.82	.59	2.65	.65	2.80	.59	4.40**

**p<0.01

The results (Table 13) indicate that at ‘duration of program in school’ dimension students’ attitudes toward some measures of learning tend to change positively over time, between 2009 and 2013. For example, students’ self-efficacy increased from mean 2.63 (SD 0.61) in 2009 to mean 2.83 (SD 0.57) in 2013 ($F_{(3,765)} = 4.05$ $p<0.01$). This change was significant for self-efficacy and evaluation of the learning process. Scheffe post hoc tests indicate that the difference is between 2011 and 2013.

For further examination of these findings, we compared the perceptions of different students at specific grade levels between 2011 and 2013, according to the SPIBA motivation scales, students' perceptions towards a 1:1 laptop program and general attitudes towards learning. In the data analysis, we used an independent samples t-test, since we compared different students.

Table 14: SPIBA motivation scales, different students in 7th grade, 2011, 2013

	7th grade				
	2011 (N=115)		2013 (N=55)		
	M	*SD*	*M*	*SD*	t-value
Intrinsic goal orientation	4.76	1.27	5.32	1.06	-2.85**
Extrinsic goal orientation	5.21	1.34	5.59	1.25	-1.79
Task value	5.09	1.38	5.43	1.36	-1.49
Control of learning beliefs	4.77	1.31	5.13	1.37	-1.64
Self-efficacy for learning and performance	5.30	1.25	5.56	1.13	-1.33

**p<0.01 *p<0.05

Table 15: SPIBA motivation scales, different students in 8th grade, 2011, 2013

	8th grade				
	2011 (N=116)		2013 (N=142)		
	M	*SD*	*M*	*SD*	t-value
Intrinsic goal orientation	4.53	1.45	4.65	1.23	-0.72
Extrinsic goal orientation	4.58	1.59	5.24	1.44	-3.47**
Task value	4.74	1.57	5.08	1.44	-1.79
Control of learning beliefs	4.30	1.54	4.82	1.23	-2.89**
Self-efficacy for learning and performance	4.81	1.49	5.19	1.33	-2.11*

**p<0.01 *p<0.05

Table 16: SPIBA motivation scales, different students in 9th grade, 2011, 2013

	9th grade				
	2011 (N=105)		2013 (N=96)		
	M	*SD*	*M*	*SD*	t-value
Intrinsic goal orientation	4.06	1.53	4.44	1.38	-1.82
Extrinsic goal orientation	4.61	1.52	4.79	1.62	-0.81
Task value	4.28	1.57	4.60	1.50	-1.47
Control of learning beliefs	4.16	1.48	4.50	1.39	-1.67
Self-efficacy for learning and performance	4.98	1.36	4.95	1.50	0.13

Findings (Tables 14-16) suggest that students who started the program at a later stage tended to display more positive attitudes compared to students who participated in the program in its first years. This is evident especially for 8th grade students. For example, 8th grade students' extrinsic goal orientation increased from mean 4.58 (SD 1.59) in 2011 to mean 5.24 (SD 1.44) in 2013 ($t_{(253)} = -3.47$ $p<0.01$).

Table 17: SPIBA-TPB factors, different students in 7th grade, 2011, 2013

	7th grade				
	2011 (N=115)		2013 (N=55)		
	M	*SD*	*M*	*SD*	t-value
Attitudes towards learning with a 1:1 laptop[1]	5.05	1.47	5.36	1.38	-1.32
Self-efficacy towards learning with a 1:1 laptop[1]	5.25	1.22	5.51	1.20	-1.29
School norms towards 1:1 learning[1]	5.10	1.84	5.41	1.66	-1.01
Behavioral intention: Intention to learn with a 1:1 laptop[1]	5.27	1.24	5.55	1.11	-1.43
Behavior: learning with a 1:1 laptop[2]	2.71	.51	2.78	.59	-0.72

1-7 point scale
2- 4 point scale

Table 18: SPIBA-TPB factors, different students in 8th grade, 2011, 2013

	8th grade				
	2011 (N=116)		2013 (N=142)		
	M	*SD*	*M*	*SD*	t-value
Attitudes towards learning with a 1:1 laptop[1]	4.76	1.62	5.02	1.48	-1.36
Self-efficacy towards learning with a 1:1 laptop[1]	4.78	1.54	5.12	1.36	-1.90
School norms towards 1:1 learning[1]	4.54	2.18	5.21	1.86	-2.52**
Behavioral intention: Intention to learn with a 1:1 laptop[1]	4.70	1.53	5.18	1.27	-2.69**
Behavior: learning with a 1:1 laptop[2]	2.51	.74	2.73	.57	-2.63**

1-7 point scale
2- 4 point scale
**p<0.01

Table 19: SPIBA-TPB factors, different students in 9th grade, 2011, 2013

	9th grade				
	2011 (N=105)		2013 (N=96)		
	M	*SD*	*M*	*SD*	t-value
Attitudes towards learning with a 1:1 laptop[1]	4.15	1.66	4.52	1.59	-1.61
Self-efficacy towards learning with a 1:1 laptop[1]	4.92	1.44	4.90	1.49	0.09
School norms towards 1:1 learning[1]	4.24	2.06	4.63	2.05	-1.35
Behavioral intention: Intention to learn with a 1:1 laptop[1]	4.70	1.46	4.82	1.52	-0.58
Behavior: learning with a 1:1 laptop[2]	2.56	.60	2.49	.61	0.85

1-7 point scale
2- 4 point scale

Like the findings of the SPIBA motivation scales, these showed that students who started the program at a later stage tended to display more positive attitudes compared to students who participated in the program in its first years (Tables 17-19). Again, this change was evident especially in 8th grade students. For example, 8th grade students' behavioral intention to learn with a 1:1 laptop increased from mean 4.70 (SD 1.53) in 2011 to mean 5.18 (SD 1.27) in 2013 ($t_{(222.96)} = -2.69$ $p<0.01$).

Tables 20-22 present the results of students' general attitudes towards their learning, comparing the attitudes of different students who started the program in different years. They are similar to the findings of the SPIBA components and TPB and suggest an increase in students' attitudes over the years, especially for students in the 8th grade. For example, 8th grade students' perception of their general learning skills increased from mean 2.77 (SD 0.65) in 2011 to mean 3.07 (SD 0.54) in 2013 ($t_{(223.294)} = -3.90$ $p<0.01$).

Table 20: SPIBA General attitudes towards learning, different students in 7th grade 2011, 2013

	7th grade				
	2011 (N=115)		2013 (N=55)		
	M	*SD*	*M*	*SD*	t-value
General learning skills	3.04	.50	3.14	.53	-1.20
Self-efficacy	2.83	.57	3.01	.52	-1.88
Evaluation of the learning process	2.71	.58	2.96	.51	-2.75**

**p<0.01

Table 21: SPIBA General attitudes towards learning, different students in 8th grade 2011, 2013

	8th grade				
	2011 (N=116)		2013 (N=142)		
	M	*SD*	*M*	*SD*	t-value
General learning skills	2.77	.65	3.07	.54	-3.90**
Self-efficacy	2.69	.61	2.87	.51	-2.68**
Evaluation of the learning process	2.59	.72	2.80	.58	-2.66**

**p<0.01 *p<0.05

Table 22: SPIBA General attitudes towards learning, different students in 9th grade 2011, 2013

	9th grade				
	2011 (N=105)		2013 (N=96)		
	M	*SD*	*M*	*SD*	t-value
General learning skills	2.99	.53	2.86	.59	1.61
Self-efficacy	2.66	.60	2.67	.64	-0.18
Evaluation of the learning process	2.64	.64	2.69	.64	-0.56

In conclusion, our findings vary between the two dimensions that were tested: 'duration of learning' – the effect of learning in the program on the same students; and 'duration of program in school' – the effect of the program on different students in different school years. At the 'duration of learning' dimension students' (same students) motivation and perceptions towards a 1:1 laptop program tend to decline over time, between 7th and 9th grade. However, at the 'duration of program in school' dimension we found an increase in students' perceptions towards a 1:1 laptop program over time. In other words, students who participated in the 1:1 program at a later stage (after it started) tended to show more positive attitudes compared to students who participated in earlier years of the 1:1 laptop program in school. These tendencies were found for the SPIBA motivation scales, students' perceptions towards a 1:1 laptop program based on the TPB, and students' general attitudes towards learning.

Discussion

This study began during the third year of a 1:1 laptop program and was conducted over five years, a period of time that contributed to a longitudinal perspective on the program and allowed us to examine it as part of the school's daily routine, rather than as an innovative initiative (Lei, 2010). The findings indicate an "up & down" effect, where the attitudes and motivation of students towards learning with a 1:1 laptop change over the years, but this change is not the same when viewed in terms of 'duration of learning' – the effect of learning in the program on the same students; and 'duration of program in school' – the effect of the program on different students in different school years.

At the 'duration of learning' dimension, we found – in the case of both students' cohorts – that students' motivation and attitudes declined as they moved between 7th and 9th grades. This tendency may be related to the decrease in students' enthusiasm over time towards using a 1:1 personal laptop 24/7 as it becomes a routine, but may also be related to the fact that the participants know that the 1:1 program does not continue in high school. A decrease in students' attitudes was reported in the research literature, especially after the first year of a 1:1 program, but recovery was sometimes found between the second and third year (Swallow, 2015). A decline in other aspects of learning with 1:1 laptops, such as student engagement, has also been reported over time (Hur & Oh, 2012). The results of the SEM analysis emphasize the effect of students' attitudes and self-efficacy on their intention to learn with a 1:1 laptop, so it is crucial to consider what might be done to maintain the students' attitudes towards 1:1 learning and to strengthen self-efficacy and school norms in this context. Otherwise, students' attitudes toward use of their personal laptops may decrease.

However, at the 'duration of program in school' dimension, students' attitudes and motivation increased between 2009-2013. Students in year 2013 displayed more positive attitudes than students from the years before them. The data analysis at the 'duration of program in school' dimension also indicated 8th grade as a significant stage in which students' attitudes and motivation tended to improve over time. Thus, in terms of technology integration, 8th grade is a meaningful time to enhance students' motivation and ICT skills in junior high school. In 9th grade, students may know they are headed to a high school without a 1:1 program and therefore may lose their motivation to study with personal laptops.

These findings may indicate that students who participated in the program in later years were better prepared in terms of their expectations from the program and from 1:1 learning. Spanos and Sofos (2015) found that in a 1:1 laptop program that operated in an elementary and junior high school, the younger students' attitudes were more positive, an aspect that may indicate that students are better prepared for 1:1 learning over time. Another explanation for these findings lies in the fact that in the first years of the laptop implementation, students and teachers need to adapt to a new way of teaching and learning and dedicate time to learning new skills. Over time their skills and the laptop integration improved (Kopcha, 2012; Zheng et al., 2016). The influence of time was also found on students' achievements, which showed a positive effect only after the second year of implementation (Grimes & Warschauer, 2008). Hence, an explanation for the findings of this study may be that students who started junior high school when the 1:1 program was established had better computer skills and learned with more experienced teachers who had already adapted to this new way of teaching and learning. This may be one of the reasons their attitudes are higher than the students who participated in the earlier years of the program and experienced the difficulties of the program's establishment.

This explanation is supported by findings from a long-term research that was conducted on a 1:1 laptop program in the US and found that the use of technology is constantly changing, according to various elements of the school system: technology users, school resources, and the relationships between these systems. In the second year, the program implementation changed to deal with issues that were not predictable at first (Lei, 2010). Therefore, technology integration in schools needs to be continuously adjusted, over time, according to the needs of the school, the increased skills of teachers and students, and new technological developments.

Conclusions

Due to the high and extensive costs of 1:1 programs, teachers, parents, and policymakers are waiting to see proof of their contribution before investing in additional programs. Further understanding the impact of 1:1 laptops on students and their learning will support the development of future programs (Fleischer, 2012; Zheng et al., 2014). Therefore, in this study we aimed to find out students' attitudes, perceived school norms, self-efficacy, and intention to learn with a 1:1 laptop, in terms of the Theory of Planned Behavior. We also wished to find out whether students' attitudes and perceptions towards learning with a 1:1 laptop are stable, or whether they change over time.

Regarding the first research question, our findings reveal that the Theory of Planned Behavior is feasible in this setting of a 1:1 laptop program. In accordance with the theory, students' attitudes, perceived school norms and self-efficacy significantly contributed to their intention to learn with a 1:1 laptop. Their self-efficacy and intention also significantly contributed to their behavior in terms of learning with a 1:1 Laptop.

Regarding the second research question, we found that attitudes and motivation of students towards learning with a 1:1 laptop changed over the years—what we called an "up & down effect". Students' attitudes, perceived school norms, self-efficacy, and intention to learn with a laptop tended to decline between the beginning and end of junior high school. However, the same measures (students' attitudes, perceived school norms, self-efficacy, and intention to learn with a laptop) tended to increase the longer the duration of the 1:1 program in school. Therefore, the duration of the 1:1 program in school can positively affect the attitudes and perceptions of students over time.

The findings revealed in this study can assist the implementation of similar programs. The findings emphasize the importance of longitudinal maintenance of students' self-efficacy and attitudes towards learning in 1:1 laptop settings, as these can affect students' intentions to use laptops in the future, and may affect the programs' sustainability. The study also highlights that students' attitudes towards 1:1 learning may change at different ages. In this study, 8th grade was found to be an important time to enhance students' motivation and ICT skills.

Future research can follow 1:1 programs over time in order to detect if the "up & down" effect identified in this study occurs in other programs, in different schools, and in various contexts. Differences in culture, gender, age, socio-economic status, and other student characteristics can have a significant impact on attitudes and achievements in 1:1 laptop programs. Furthermore, teachers' attitudes are another important aspect that may impact students' technology acceptance. Teachers' attitudes in the 1:1 program presented here were explored by Doron and Spektor-Levy (2015). Future research could investigate teachers' attitudes in light of the "up & down" effect. These may be investigated through qualitative methodologies.

Our study has limitations: the small number of students that participated in 2009; the factor 'subjective norms: school norms towards 1:1 learning' is composed from one item, therefore reliability was not calculated. These limitations should be dealt with in future studies. However, the findings of this longitudinal study do show the trends in students' perceptions about learning in a 1:1 laptop model and emphasize the complex impact of these programs on their students, which may vary between different measurements and dimensions: the duration of learning in the program and the duration of the program in school.

References

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), *Action-control: From cognition to behavior* (pp. 11-39). Heidelberg, Germany: Springer.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179-211. doi: 10.1016/0749-5978(91)90020-T

American Library Association. (2000). *Information literacy competency standards for higher education*. Retrieved February 15, 2015, from http://www.ala.org/acrl/sites/ala.org.acrl/files/content/standards/standards.pdf

Balanskat, A., Bannister, D., Hertz, B., Sigillò, E., & Vuorikari, R. (2013). *Overview and analysis of 1:1 learning initiatives in Europe.* Institute for Prospective and Technological Studies, Joint Research Centre. Retrieved February 15, 2015 from http://ftp.jrc.es/EURdoc/JRC81903.pdf

Bebell, D., & Kay, R. (2009). Summary of research findings from the Berkshire 1:1 Laptop Program. Paper presented at the *Annual Meeting of the National Educational Computing Conference*. Retrieved June 1, 2016 from http://www.bc.edu/research/intasc/PDF/BWLI_Year3Report.pdf

Bennett, S., & Maton, K. (2010). Beyond the 'digital natives' debate: Towards a more nuanced understanding of students' technology experiences. *Journal of Computer Assisted Learning*, *26*(5), 321-331. doi: 10.1111/j.1365-2729.2010.00360.x

Blackley, S., & Walker, R. (2015). One-to-one laptop programs: Is transformation occurring in mathematics teaching. *Issues in Educational Research*, *25*(2), 99-117.

Blau, I., & Peled, Y. (2012). Teachers' openness to change and attitudes towards ICT: Comparison of laptop per teacher and laptop per student programs. *Interdisciplinary Journal of e-Learning and Learning Objects*, *8*, 73-82. Retrieved June 1, 2016 from http://www.ijello.org/Volume8/IJELLOv8p073-082Blau0800.pdf

Cavanaugh, C., Dawson, K., & Ritzhaupt, A. (2012). An evaluation of the conditions, processes, and consequences of laptop computing in K-12 classrooms. *Journal of Educational Computing Research*, *45*(3), 359-378. doi: 10.2190/EC.45.3.f

Cheon, J., Lee, S., Crooks, S. M., & Song, J. (2012). An investigation of mobile learning readiness in higher education based on the theory of planned behavior. *Computers & Education*, *59*(3), 1054-1064. doi: 10.1016/j.compedu.2012.04.015

Courtois, C., Montrieux, H., De Grove, F., Raes, A., De Marez, L., & Schellens, T. (2014). Student acceptance of tablet devices in secondary education: A three-wave longitudinal cross-lagged case study. *Computers in Human Behavior*, *35*, 278-286. doi: 10.1016/j.chb.2014.03.017

Crook, S. J., Sharma, M. D., Wilson, R., & Muller, D. A. (2013). Seeing eye-to-eye on ICT: Science student and teacher perceptions of laptop use across 14 Australian schools. *Australasian Journal of Educational Technology, 29*(1), 82-95. doi: 10.1080/09500693.2014.982229

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319-340.

Doron, E., & Spektor-Levy, O. (2015). *The evolvement of teachers' role and professional identity in 1:1 personal laptop classrooms.* Paper presented at the EARLI - 16th Biennial Conference, Limassol, Cyprus.

Dunleavy, M., Dexter, S., & Heinecke, W.F. (2007). What added value does a 1:1 student to laptop ratio bring to technology-supported teaching and learning? *Journal of Computer Assisted Learning*, *23*, 440–452. doi: 10.1111/j.1365-2729.2007.00227.x

Fleischer, H. (2012). What is our current understanding of one-to-one computer projects: A systematic narrative research review. *Educational Research Review*, *7*(2), 107-122. doi:10.1016/j.edurev.2011.11.004

Fraillon, J., Ainley, J., Schulz, W., Friedman, T., & Gebhardt, E. (2014). *Preparing for life in a digital age. The IEA international computer and information literacy study international report.* Champagne, IL: Springer. doi: 10.1007/978-3-319-14222-7

Grant, B. M. M., & Carolina, S. (2015). Teaching and learning with mobile computing devices: Case study in K-12 Classrooms. *TechTrends*, *59*(4). doi: 10.1007/s11528-015-0869-3

Grimes, D., & Warschauer, M. (2008). Learning with laptops: A multi-method case study. *Journal of Educational Computing Research*, *38*(3), 305-332. doi: 10.2190/EC.38.3.d

Harper, B., & Milman, N. B. (2016). One-to-one technology in K–12 classrooms: A review of the literature from 2004 through 2014. *Journal of Research on Technology in Education*, *48*(2), 129-142. doi: org/10.1080/15391523.2016.1146564

Holcomb, L. (2009). Results and lessons learned from 1:1 laptop initiatives: A collective review. *TechTrends*, *53*(6), 49-55. doi: 10.1007/s11528-009-0343-1

Hooft, M., Swan, K., Cook, D., & Lin, Y. (2007). What is ubiquitous computing? In M. Hooft & K. Swan (Eds.), *Ubiquitous computing in education: Visible technology invisible outcomes* (pp. 3-19). Lawrence Erlbaum Associates.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1-55. doi: 10.1080/10705519909540118

Hu, W. (2007, May 4). Seeing no progress, some schools drop laptops. *The New York Times*. Retrieved February, 15 2015 from http://www.nytimes.com/2007/05/04/education/04laptop.html?pagewanted=all&_r=0

Hur, J. W., & Oh, J. (2012). Learning, engagement, and technology: Middle school students' three-year experience in pervasive technology environments in South Korea. *Journal of Educational Computing Research*, *46*, 295-312. doi:10.2190/EC.46.3.e

Islam, M. S., & Grönlund, Å. (2016). An international literature review of 1: 1 computing in schools. *Journal of Educational Change*, *17*(2), 191-222. doi: 10.1007/s10833-016-9271-y

Kay, K. (2010). 21st century skills: Why they matter, what they are, and how we get there. In J. Bellanca, & R. Brandt (Eds.), *21st century skills: Rethinking how students learn*. Bloomington, IN: Soloution Tree.

Kline, R. B. (2011). *Principles and practice of structural equation modeling*. New York: Guilford publications.

Kopcha, T. J. (2012). Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development. *Computers & Education*, *59*(4), 1109-1121. doi: 10.1016/j.compedu.2012.05.014

Léger, M. T., & Freiman, V. (2016). A narrative approach to understanding the development and retention of digital skills over time in former middle school students, a decade after having used one-to-one laptop computers. *Journal of Research on Technology in Education*, *48*(1), 57-66. doi: 10.1080/15391523.2015.1103150

Lei, J. (2010). Conditions for ubiquitous computing: What can be learned from a longitudinal study. *Computers in the Schools*, *27*(1), 35-53.doi:10.1080/07380560903536264

Lowther, D. L., Inan, F. A., Ross, S. M., & Strahl, J. D. (2012). Do one-to-one initiatives bridge the way to 21st Century knowledge and skills? *Journal of Educational Computing Research*, *46*(1), 1-30. doi: 10.2190/EC.46.1.a

Lowther, D. L., Ross, S., & Morrison, G. (2003). When each one has one: The influences on teaching strategies and student achievement of using laptops in the classroom. *Educational Technology, Research and Development*, *51*(3), 23-44. doi: 10.1007/BF02504551

Menashe, K. (2008). Learning with laptops and virtual campus as a routine: Development of learning capabilities, information literacy and affective aspects among 6th and 7th grade school students. (Unpublished master's thesis).School of Education, Bar Ilan University, Israel. [In Hebrew]

Mouza, C. (2008). Learning with laptops: Implementation and outcomes in an urban, under-privileged school. *Journal of Research on Technology in Education*. *40*(4), 447-472. doi: 10.1080/15391523.2008.10782516

Nachmias, R., Mioduser, D., & Forkosh Baruch, A. (2009). *SITES 2006 ICT in mathematics and science education study in Israel*. Ramot, Tel-Aviv. [In Hebrew].

Penuel, W. R. (2006). Implementation and effects of one-to-one computing initiatives: A research synthesis. *Journal of Research on Technology in Education*, *38*(3), 329-348. doi: 10.1080/15391523.2006.10782463

Perlman, B. (2010). Designing new learning environments to support 21st century skills. In J. Bellanca & R. Brandt (Eds.), *21st Century Skills: Rethinking how students learn*. Bloomington, IN: Solution Tree.

Pintrich, P.R., Smith, D.A.F., Garcia, T., & McKeachie, W.J. (1993). Reliability and predictive validity of the motivated strategies for learning questionnaire (MSLQ). *Educational and Psychological Measurement*, *53*, 801-813. doi: 10.1177/0013164493053003024

Resnick, M. (2002). Rethinking learning in the digital age. In G. Kirkman (Ed.), *The global information technology report: Readiness for the networked word*. Oxford, UK: Oxford University Press.

Reynolds, D., Treharne, D., & Tripp, H. (2003). ICT—The hopes and the reality. *British Journal of Educational Technology*, *34*(2), 151-167. doi: 10.1111/1467-8535.00317

Rosen, Y., & Beck-hill, D. (2012). Intertwining digital content and a one-to-one laptop environment in teaching and learning: Lessons from the time to know program. *Journal of Research on Technology in Education, 44*(3), 225-241. doi: 10.1080/15391523.2012.10782588

Spanos, D., & Sofos, A. (2015). The views and attitudes of students participating in a one-to-one laptop initiative in Greece. *Education and Information Technologies*, 1-17. doi:10.1007/s10639-013-9299-z

Spektor-Levy, O., & Granot-Gilat, Y. (2012). The impact of learning with laptops in 1:1 classes on the development of learning skills and information literacy among middle school students. *Interdisciplinary Journal of E-Learning and Learning Objects, 8*, 83-96. Retrieved from https://www.informingscience.org/Publications/1729

Spektor-Levy, O., Menashe, K., Berger-Tikochinski, T., & Doron, E. (2011). The feasibility of ubiquitous computing in school. Longitudinal Study in 1:1 classes suggests—time matters. Paper presented at the *3rd International Conference on Computer Supported Education*, Noordwijkerhout, Netherlands. Retrieved February 15, 2015, from http://www.csedu.org/Abstracts/2011/UeL_2011_Abstracts.htm .

State Comptroller. (2011). *62nd Annual report*. Retrieved May 30, 2015 from http://www.mevaker.gov.il/he/Reports/Report_117/a98fb0e6-1f5a-4c6c-8d21-3e2a4953290b/7553.pdf [In Hebrew]

Swallow, M. (2015). The year-two decline: Exploring the incremental experiences of a 1:1 technology initiative. *Journal of Research on Technology in Education*, *47*(2), 122-137. doi: 10.1080/15391523.2015.999641

Teo, T. (2015). Comparing pre-service and in-service teachers' acceptance of technology: Assessment of measurement invariance and latent mean differences. *Computers & Education*, *83*, 22-31. doi:10.1016/j.compedu.2014.11.015

Valtonen, T., Kukkonen, J., Kontkanen, S., Sormunen, K., Dillon, P., & Sointu, E. (2015). The impact of authentic learning experiences with ICT on pre-service teachers' intentions to use ICT for teaching and learning. *Computers & Education*, *81*, 49-58. doi:10.1016/j.compedu.2014.09.008

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, *27*(3), 425-478.

Warschauer, M. (2007). Information literacy in the laptop classroom. *Teachers College Record, 109*, 2511-2540.

Warschauer, M. (2008). Laptops and literacy: A multi-site case study. *Pedagogies*, *3*, 52-67. doi: 10.1080/15544800701771614

Zheng, B., Arada, K., Niiya, M., & Warschauer, M. (2014). One-to-one laptops in K-12 classrooms: Voices of students. *Pedagogies: An International Journal*, *9*(4), 279-299. doi: 10.1080/1554480X.2014.955499

Zheng, B., Warschauer, M., Lin, C. H., & Chang, C. (2016). Learning in one-to-one laptop environments: A meta-analysis and research synthesis. *Review of Educational Research*. doi: 10.3102/0034654316628645

Biographies

Tal Berger-Tikochinski is a PhD candidate at the School of Education at Bar-Ilan University. She holds a B.A degree in Behavioral Sciences from Ben-Gurion University and an M.A degree in Sociology of Education from the Hebrew University of Jerusalem, Israel. Mrs. Berger-Tikochinski is a researcher at the Henrietta Szold Institute – The National Institute for Research in the Behavioral Sciences in Israel.

Prof. Michal Zion, PhD, from The Hebrew University, Jerusalem, Israel, in Molecular Biology (Cancer Research). Prof Zion is a Vice Director, School of Education; Head of the Science Education Program and the Biology Teaching Program, the School of Education, Bar-Ilan University, Ramat-Gan, Israel. She is the Academic Head of The National Center for Support and Development of Biology School Laboratories. Her main research interests include inquiry-based learning and teaching; Developing scientific environmental and health literacy; Metacognition; Homeostasis - a fundamental principle in biology education; Computer-based learning environments.

Dr. Ornit Spektor-Levy is a faculty member at the Science Education Center, School of Education, Bar Ilan University. PhD from the Weizmann Institute for Science. Her educational research focuses on Scientific communication, ICT in education, information literacy, development of scientif99ic curiosity and literacy, professional development of science teachers. She is the director of the Israeli National teacher center for STEM in preschool.

This page left blank intentionally

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Friedman, A., Blau, I., & Eshet-Alkalai, Y. (2016). Cheating and feeling honest: Committing and punishing analog versus digital academic dishonesty behaviors in higher education. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 193-205. Retrieved from http://www.informingscience.org/Publications/3629

Cheating and Feeling Honest: Committing and Punishing Analog versus Digital Academic Dishonesty Behaviors in Higher Education

Adi Friedman, Ina Blau, and Yoram Eshet-Alkalai
The Open University of Israel, Ra'anana, Israel

adifr@openu.ac.il inabl@openu.ac.il yorames@openu.ac.il

Abstract

This study examined the phenomenon of academic dishonesty among university students. It was based on Pavela's (1997) framework of types of academic dishonesty (cheating, plagiarism, fabrication, and facilitation) and distinguished between digital and "traditional"- analog dishonesty. The study analyzed cases of academic dishonesty offenses committed by students, as well as the reasons for academic dishonesty behaviors, and the severity of penalties for violations of academic integrity. The motivational framework for committing an act of academic dishonesty (Murdock & Anderman, 2006) and the Self-Concept Maintenance model (Mazar, Amir, & Ariely, 2008) were employed to analyze the reasons for students' dishonest behaviors. We analyzed 315 protocols of the Disciplinary Committee, at The Open University of Israel, from 2012-2013 that represent all of the offenses examined by the Committee during one and a half years. The findings showed that analog dishonesty was more prevalent than digital dishonesty. According to the students, the most prevalent reason for their academic dishonesty was the need to maintain a positive view of self as an honest person despite violating ethical codes. Interestingly, penalties for analog dishonesty were found to be more severe than those imposed for digital dishonesty. Surprisingly, women were penalized more severely than men, despite no significant gender differences in dishonesty types or in any other parameter explored in the study. Findings of this study shed light on the scope and roots of academic dishonesty and may assist institutions in coping effectively with this phenomenon.

Keywords: digital academic dishonesty, cheating, plagiarism, fabrication, facilitation, academic integrity in higher education, motivation for academic dishonesty, gender differences in penalties given for academic dishonesty

Introduction

In recent years the phenomenon of academic dishonesty has gained momentum among university students. Furthermore, a significant proportion of cases of academic dishonesty are digital dishonesty behaviors, which are conducted through a technological device, such as a smartphone, and an application, such as email or a social network (Stogner, Miller, & Marcum, 2013). The broad scope of academic dishonesty is evident from several studies. For example, Cheshin (2006) found that 95% of the

Editor: Janice Whatley

An earlier, shorter version of this paper was presented at the Chais conference 2016, in Raanana, Israel, and included in Y. Eshet-Alkalai, I. Blau, A. Caspi, N. Geri, Y. Kalman, & V. Silber-Varod (Eds.), *Proceedings of the 11th Chais Conference for the Study of Innovation and Learning Technologies 2016: Learning in the Technological Era*. Raanana: The Open University of Israel.

students in Israel admitted having committed some form of academic dishonesty, some 60% had been involved in copying papers, and some 60% had been involved in copying during exams. In a study conducted in Korea, 69% of the participating students admitted that they had committed at least one of the most common forms of dishonesty – cheating, plagiarism, and facilitation (Ledesma, 2011). Similar data can be found in educational systems elsewhere in the world (Bretag, 2016).

This study focused on the phenomenon of both analog and digital academic dishonesty, aiming to analyze its most prevalent manifestations, its inhibiting and promoting factors, and the severity of penalties imposed for conducting acts of dishonesty by students.

Literature Review and Frameworks

Studies on academic dishonesty indicate that, as a rule, institutions have difficulty coping with the phenomenon because they are concerned about damaging their reputation. As a result, many institutions tend to "sweep the issue under the carpet" (Brimble, 2016; Whitley & Keith-Spiegel, 2002).

In light of the increase in cases of violation of academic integrity in recent years, the research literature has examined the contribution of available digital technologies to academic dishonesty, and claims that the ease of conducting *digital academic dishonesty* encourages the phenomenon (Stogner et al., 2013). Recent research literature (e.g., Brimble, 2016; Sutherland-Smith, 2016) suggests that the digital environment seems to promote academic misconduct because of the easiness of cutting and pasting texts (plagiarism), buying/selling academic assignments and papers for re-submission (contract cheating), hiring others to write assignments and papers for students (ghost writing), and conducting online discussions that are not permitted by the institution (collusion) According to these claims, the unlimited availability of open information, and in many cases the lack of identity of the authors (such as in Wikipedia), often blur the boundaries between ethical and non-ethical behaviors and increase acts of academic dishonesty by students and even by teachers (Alroi-Stein, 2008). This claim is supported by findings from a recent rigorously conducted field experiment (Kauffman & Young, 2015), in which the use of a plagiarism-detecting app revealed that about 80% of the participating students engaged in digital plagiarism. Moreover, the technological affordances of the writing assignment to support plagiarism (i.e., the possibility of easily copy-pasting text from internet pages) versus the special precaution taken by the researchers against plagiarism (by using jpeg format of text), impacted plagiarism far beyond the participants' writing goals which were prompted prior to the experiment (i.e., learning/mastery versus performance goals). Some studies on academic dishonesty (e.g., Jones & Sheridan, 2015) report that sophisticated students are involved in cyber-facilitated plagiarism known as "back translation", in which students run text through language translation software in order to avoid detection of plagiarism by software. Other authors (e.g., Davies & Howard, 2016) contend that there is no empirical evidence to corroborate the widespread fear that digital plagiarism is increasing.

The mapping of academic dishonesty in the current study is based on the *conceptual framework* of Pavela (1997), which relates to four types of dishonesty:

> *Cheating* – the intentional use of study materials, information, or any kind of aid, the use of which is not allowed, including consulting with other people;
>
> *Plagiarism* – the use of content written by others and presenting it without crediting the source, as if it were one's own;
>
> *Fabrication* – the intentional fabrication of information, data, or references that do not actually exist;
>
> *Facilitation* – intentional assistance in the academic dishonesty behavior of others

Although it is one of the most widely accepted models today in terms of describing academic dishonesty, it is important to note that Pavela's (1997) model was developed before digital technologies became the key tools in social communication as well as in the location and storage of information. Hence a study applying it to the digital era can examine its validity today and suggest necessary modifications to it (Blau & Eshet-Alkalai, 2014, 2015).

Motivations for conducting academic dishonesty can be analyzed from ethical, pedagogical, economic, and psychological points of view (Blau & Eshet-Alkalai, 2016; Fishman, 2016). The findings of authors embracing the ethical perspective (e.g., Newton, 2016) have shown that students who were more confident in their understanding of plagiarism as a problematic behavior not only performed better on simple tests of referencing, but also recommended more severe penalties for conducting academic dishonesty offenses.

In the current study, we applied Murdock and Anderman's (2006) model of motivations for academic dishonesty, which analyzes academic integrity from pedagogical, economic, and psychological perspectives. The model, which is based on a meta-analysis of extensive research literature, contains three categories of motives: the student's goals, the student's evaluation of the manner in which these goals are attained, and the student's evaluation of the benefits versus the costs of conducting the act of academic dishonesty. In this model, the factors that promote dishonesty are mainly those that emphasize elements which are external to learning (e.g., focusing on the grades rather than on the development of mastery, low self-efficacy of academic performance, poor quality of teaching, perception of assessment level as too high or unfair, and the expectation that the penalty for being caught will not be severe).

This typology of the motivation for academic dishonesty was compared in our study to that of the Self-Concept Maintenance Model (Mazar, Amir, & Ariely, 2008). From this psychological perspective, at the individual level, the key factor for committing academic dishonesty is not the benefit or the cost but rather the ability to maintain one's self-image as an honest person, despite conducting the dishonest act. On the other hand, at the group level, when other people might benefit from the dishonest act (e.g., helping friends write a seminar paper), the ethical considerations are weakened and the willingness to deceive increases (Friedman, Blau, & Eshet, 2016). According to the Self-Concept Maintenance Model, social conventions also influence the phenomenon of dishonesty. For example, if the inappropriate behavior of one's peers is forgiven or is not addressed, it becomes a norm and thereby encourages the dishonest behavior (Ariely, 2012).

In order to improve our understanding of dishonesty in academia, this paper examined the distribution and the motivation for conducting academic dishonesty among university students.

Research Questions

The research questions are as follows:

1. Are there differences in the frequency of *academic dishonesty types* (according to the model of Pavela, 1997) between analog dishonesty and digital dishonesty?
2. What is the frequency of the types of *motivation* to be dishonest (according to the model of Murdock and Anderman, 2006)?
3. What differences are there in the severity of the actual and probationary *penalties* imposed for analog versus digital acts of academic dishonesty, and for the dishonest acts committed on different types of assessments (exams, seminar papers, and homework assignments)?
4. Are there *gender differences* in the frequency of acts of analog versus digital academic dishonesty, in different types of assessments (exams, papers, homework), and in the severity of penalties (either actual or probationary) imposed for these behaviors? Note that in contrast to

actual penalties which are imposed immediately, probationary penalties refer to potential and usually more severe penalties that will be imposed on a student for repeating similar offenses in the future.

Method

Research Population

This study analyzed 315 protocols of the Disciplinary Committee of the Open University of Israel which deals with violations of academic integrity by its undergraduate and graduate students. Note that the retrospective analysis of the Disciplinary Committee protocols was conducted without the participation of the students who were sentenced, but rather according to the Disciplinary Committee's records alone.

The rulings are available to the public once the student's personal data and the identification of courses in which academic dishonesty behaviors were committed have been removed. The protocols contain the following information: details about the offense, the student's reasons for committing it, the presence or absence of the student at the hearing, the committee's decision, and justification of the penalty (if one has been imposed). The protocols analyzed in this study were all cases that the Disciplinary Committee dealt with during the year 2012 and the first half of 2013.

Research Tools and Procedure

The frequency of the *academic dishonesty types* was identified by encoding the act described in each Disciplinary Committee protocol according to Pavela's (1997) model (i.e., cheating, plagiarism, fabrication, and facilitation) and distinguishing between digital and analog academic dishonesty (Blau, Eshet-Alkalai, & Rotem, 2014; Rotem, Blau & Eshet-Alkalai, 2016).

The *reasons for committing the offense* stated in the protocols were encoded and analyzed using the model of motivation for academic dishonesty (Murdock & Anderman, 2006): (1) extrinsic/intrinsic learning goals, (2) performance/mastery orientation, (3) low/high self-efficacy of academic performance, (4) low/high learning outcome expectations, (5) low/high perception of the chances of getting caught and punished, and (6) potential positive/negative view of self after conducting the offense. The last two codes (5 and 6), based on the model by Murdock and Anderman, were compared to the perspective offered by the model of behavioral ethics (Mazar et al., 2008), according to which the key factors in committing academic dishonesty are not cost-benefit considerations but rather the desire to maintain one's self-image as an honest person, despite conducting the dishonest act. The motivations for conducting offenses were coded independently by two raters for the entire set of protocols. In cases of disagreement, the cases were discussed until full agreement was reached.

In addition, *the actual and probationary penalties* imposed by the Committee were encoded (see the Appendix for details of the penalties and their degree of severity). The severity of the actual and probationary penalties was based on the scale suggested by the Disciplinary Committee to its members. The scores for the penalties were independently assessed by two raters and then discussed until that total agreement was obtained. Following that, the scores were revised by the third rater. In cases in which students were given more than one penalty, the severity was calculated as the sum of the codes for all penalties. The most severe form of penalty – permanent suspension – was coded to be significantly higher than the sum of other penalties simultaneously imposed by the Disciplinary Committee over the years. The penalty was examined on a scale from 0- acquittal to 40-permanent suspension (for actual penalty - range: 0-40, average: 9.60, standard deviation: 7.713, median: 9, skewness: 1.063; for probationary penalty - range: 3-40, average: 14.37, standard deviation: 8.894, median: 13, skewness: 1.922).

Findings and Discussion

This section first analyzes types of digital and analog academic dishonesty as well as motivations of students for dishonest behavior. Following that we discuss actual and probationary penalties for conducting academic dishonesty in different types of assessments. We conclude this section by presenting gender comparisons in academic dishonesty types, motivations, and penalties for these acts.

Technology and Academic Dishonesty

The study findings indicated that 68.8% of the academic dishonesty behaviors sentenced by the Disciplinary Committee during one and a half years were analog dishonesty, while only 31.2% are digital acts of dishonesty. This prevalence of analog over digital academic dishonesty in assessments of students in academia can be explained by the fact that most of the offenses were conducted during exams which are almost exclusively analog.

As for the frequency of the *academic dishonesty types* according to Pavela's framework, 78% of the cases caught and sentenced by the Disciplinary Committee involved cheating. The other 17.5% were cases of plagiarism, and 4.5% were facilitating the dishonesty of other students. Surprisingly, the protocols of the Disciplinary Committee did not show a single case of fabrication, which was the most prevalent dishonesty type in a previous study among school students (Blau & Eshet-Alkalai, 2014, 2015, 2016). These differences can be explained by the research population – university students as opposed to school students– and/or by the analysis of cases that were caught and punished by the Disciplinary Committee in the current study as opposed to the report of *all* of the cases of academic dishonesty in the previous study by Blau and Eshet-Alkalai (2015), including the self-report of offences that were committed by students but not detected by their teachers. An alternative explanation for this finding might be that the fabrication of data or arguments is harder to identify in the work of university students as opposed to school students.

Regarding the *correlation between the technology factor and the types of dishonesty*, a significant moderate to strong positive correlation was found (Cramer's V=.39, p=.000). Figure 1 presents the prevalence of each type of academic dishonesty separately for digital and analog offences. It shows that the majority of cases of cheating took place in an analog environment, while facilitation and plagiarism were more prevalent in a digital setting. These findings are consistent with the study among school students by Blau and Eshet-Alkalai (2014, 2015), in which plagiarism and facilitation were more prevalent and were perceived as more legitimate in a digital environment.

Regarding analog and digital dishonesty according to *the type of assessment*, most acts of dishonesty were discovered during exams, which usually do not involve the use of any technology. Nevertheless, the protocols analyzed in this study included 46 (19.6%) examples of digital dishonesty during an exam – mainly via the use of smartphones.

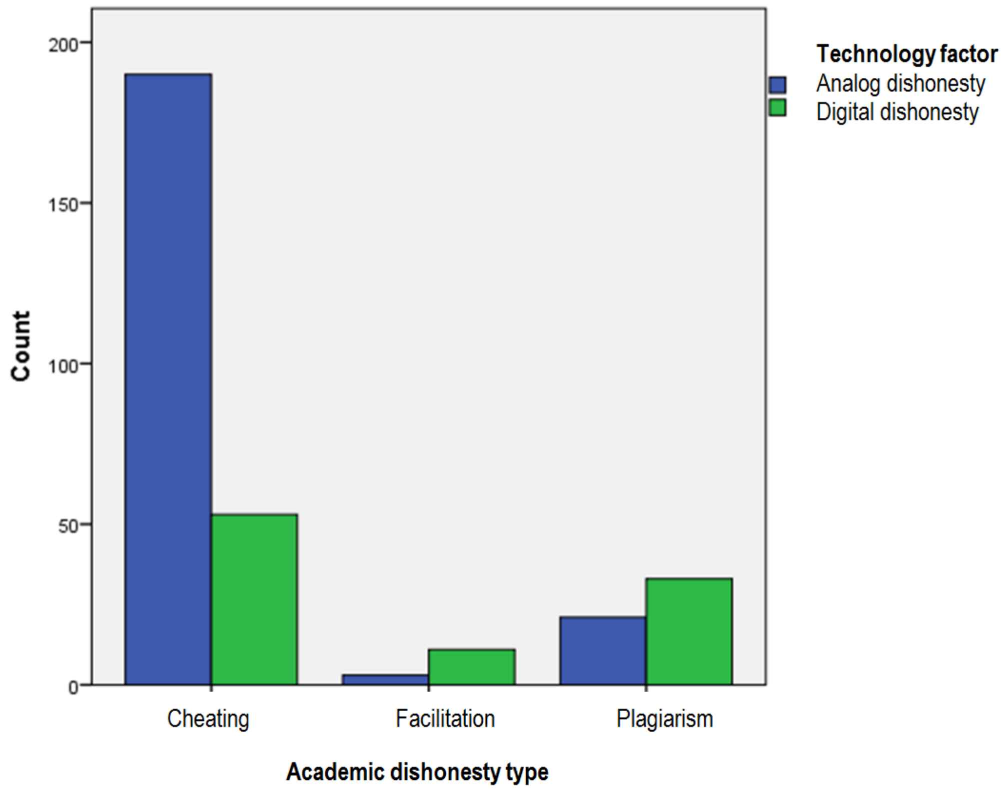


Figure 1: Types of analog and digital academic dishonesty behaviors

Motivations for Conducting Academic Dishonesty

Table 1 presents frequencies of the motivations for academic dishonesty stated by students and coded based on the model of motivations for academic dishonesty (Murdock & Anderman, 2006).

Surprisingly, findings in Table 1 indicate that most students who were caught (almost 60%) claimed that they had acted innocently, in the belief that what they did was legitimate. The study findings support the Self-Concept Maintenance Model (Mazar et al., 2008) and indicate that most of the motives for dishonesty reported by the students derive from a desire to preserve their self-image as honest people. Thus, the findings suggest that the manner of coping with academic dishonesty requires a different approach to the traditional one of imposing penalties. An example of how to prevent the phenomenon is by blurring the uncertainty students have regarding the ethical dissonance involved in committing the offense. In other words, if the student knows that an act would certainly violate their academic integrity and by committing the offense he/she becomes a dishonest person, there is a lower chance that he/she might commit it (Shalvi, Gino, Barkan, & Ayal, 2015).

Table 1 – Frequency of motivation for dishonesty based on Murdock and Anderman (2006)

Motivation for academic dishonesty	Frequency	Example from the protocols of the Disciplinary Committee
Extrinsic rather than intrinsic goals	0.6%	A student who submitted a copied home-work assignment claimed that she did so because of pressure and financial distress
High performance orientation rather than mastery orientation	10.8%	A student who submitted a copied seminar paper claimed that she did so because of time constraints and the pressure to finish her degree.
Low self-efficacy of academic performance	10.5%	A student who copied notes during an ex-am said she did so because she had diffi-culty expressing herself in writing.
Low learning outcomes expec-tations	4.1%	A student who copied on an exam said that because of family problems he had been unable to study properly for the exam.
Perception of the chances of getting caught and punished as low	10.2%	A student caught with a mobile phone dur-ing an exam claimed that he committed the offense knowing it was forbidden, but he didn't have anywhere to store the phone and didn't think someone will notice it.
Positive view of self ("inno-cence" claim) – self- percep-tion as an honest person de-spite the act of dishonesty	59.6%	A student who copied on an exam from her own notes said she did so because she did not know it was forbidden.

Penalties

Since a statistically significant difference was found between the penalties imposed in 2012 and in the first half of 2013, the data could not be combined in a single sample and this section is based on the 257 penalties imposed by the Disciplinary Committee during 2012 alone. An independent sample *t*-test was conducted to compare the severity of the penalties imposed for digital dishonesty as opposed to analog dishonesty. Table 2 presents the descriptive statistics and the analysis of variance for the severity of the actual and probationary penalties imposed on students conducting analog and digital offenses.

Table 2 – Severity of penalties imposed on students for analog or digital dishonesty in 2012

Penalty type	Dishonesty type	Average	SD	*t*
Actual	Analog	11.77	7.889	$t(256)=3.886$, $p=.000$
	Digital	7.74	7.418	
Probationary	Analog	16.46	9.493	$t(208)= 1.598$, $p=.112$
	Digital	14.42	6.434	

The results presented in Table 2 indicate that in 2012 the actual penalties for analog dishonesty were significantly more severe than those for digital dishonesty. It seems that digital dishonesty is perceived as less severe an offense than analog dishonesty – probably because the information on the internet is seen by many as the public domain and thus is not subject to copyright protection. This finding is consistent with a previous study which found that the accessibility of open online information augments academic dishonesty (Robinson-Zanartu, et al., 2005).

In order to examine the *effect of the dishonesty type on the severity of the penalty*, two univariate ANOVA tests were conducted: one for the actual penalty and the other for the probationary penalty. Table 3 shows the descriptive statistics of the tests.

Table 3 – Effect of academic dishonesty type on the severity of the penalty

Penalty / Dishonesty	Cheating Average (SD)	Plagiarism Average (SD)	Facilitation Average (SD)
Actual	10.28 (7.268)	12.15 (9.121)	7.33 (12.353)
Probationary	14.78 (7.409)	19.30 (11.044)	21.80 (16.739)

Analysis of the variance showed no statistically significant effect of the academic dishonesty type on the severity of the *actual penalties* ($F(2,255)=2.073$, $p=.128$, $\eta^2=.016$). In other words, the findings do not indicate differences in the severity of actual penalties between the types of dishonesty the students committed. In contrast, a significant effect of the dishonesty type on the severity of the *probationary penalties* was found ($F(2,207)=5.850$, $p=.03$, $\eta^2=.053$). Least Significant Difference (LSD) pairwise comparisons showed that the probationary penalties imposed for plagiarism were significantly more severe than those imposed for cheating ($p=.003$), and the probationary penalties imposed for facilitation were more severe than those imposed for cheating at a marginally significant level ($p=.07$). No significant differences were found between probationary penalties for plagiarism compared to facilitation ($p=.535$).

In addition, two univariate ANOVA tests were conducted to examine the *effect of the assessment type on the severity of the actual and probationary penalty* imposed on students for digital or analog dishonesty. Table 4 presents the descriptive statistics of these tests.

Table 4 – Effect of the assessment type on the severity of the penalty for AD

Penalty / Assessment	Exam Average (SD)	Seminar Paper Average (SD)	Homework assignment Average (SD)
Actual	9.97 (7.510)	16.67 (10.217)	10.29 (8.369)
Probationary	14.44 (7.020)	31.36 (12.220)	15.41 (7.989)

The analysis of variance indicated a significant difference in the *severity of the actual penalties* between the different types of assessment ($F(257,2)=5.090$, $p=.007$ $\eta^2=.038$). LSD pair comparisons showed that the penalties for dishonesty in writing a seminar paper were more severe than those imposed for dishonesty in an exam ($p=.002$) and for writing a homework assignment ($p=.006$). Surprisingly, no difference was found between the penalties for dishonesty in an exam and a homework assignment ($p=.779$). The possible explanation is that a seminar paper is usually written at the final stage of degree studies, is supposed to be the fruit of an extended period of work, and its weight in the GPA is relatively high. Therefore it might be considered by the Disciplinary Committee as more severe dishonesty than one conducted in an exam, which may be a preliminary stage in degree studies, or a homework assignment, the weight of which in the course grade is not very high.

Regarding the *severity of probationary penalties*, the findings of the test indicate a significant difference and a large effect size of the severity of the penalty between the different assessment types ($F(209,2)=31.704$, $p=.000$, $\eta^2=.238$). LSD pair comparisons showed that the probationary penalties for dishonesty in writing a seminar paper are more severe than those for dishonesty in an exam and for a homework assignment (p's=.000). Thus it seems that the Disciplinary Committee imposes severe penalties – actual and probationary alike – for dishonesty in writing seminar papers. Surprisingly, no statistically significant difference was found between the probationary penalties for dishonesty in an exam and in a homework assignment ($p=.477$).

Gender Differences

An independent sample *t*-test was conducted to examine the differences in the severity of the penalties as a function of students' gender. Table 5 presents the descriptive statistics and analysis of variance of the severity of the actual and probationary penalties according to gender.

Table 5 – Severity of the actual and probationary penalties by gender

Penalty type	Gender	Average	SD	*t*
Actual	Male	8.44	6.841	$t(312)=2.370$, $p=.018$
	Female	10.51	8.239	
Probationary	Male	14.50	9.123	$t(243)= .192$, $p=.848$
	Female	14.28	8.744	

Table 5 shows that, surprisingly, the actual penalties imposed on female students are significantly harsher than those imposed on male students. No significant gender differences were found for the probationary penalties. This result contradicts the findings of studies on the punishments sentenced among men as opposed to women in the courts. For example, a study that examined statistical data in the courts of the large states in the USA between 1990 and 1996 found that women were *less* severely punished than men (Steffensmeier & Demuth, 2006).

In an attempt to explain the gender differences identified in the severity of actual penalties, we examined whether gender differences are present in other parameters described in the protocols. No significant gender difference was found in analog dishonesty as opposed to digital dishonesty ($\chi^2_{(1)}=.021$, $p=.886$). Also, no significant difference was found between the genders in the type of assessment ($\chi^2_{(2)}=1.239$, $p=.538$). Hence our findings do not show gender differences between analog and digital dishonesty and the types of assessment (exam, seminar paper, and homework assignment). Moreover, it should be noted that no gender differences were found for the parameters of the appearance of a student before the committee, the cooperation of the student when caught in the dishonesty act, or the parameter of whether the student admitted guilt and expressed remorse. Thus, the disturbing gender differences in the severity of penalty imposed the Disciplinary Committee cannot be explained by the different academic dishonesty behavior of female students or their unwillingness to cooperate after being caught. This finding might be related to the fact that during the period analyzed in this study the Committee only consisted of men and we recommend that academic institutions adopt more gender-balanced compositions of Disciplinary Committees.

Conclusion and Implications

This study explored the phenomenon of analog and digital academic dishonesty, aiming to analyze its most common manifestations, the factors that lead students to commit it, the severity of penalties imposed for it by the Disciplinary Committee and gender differences in these penalties. Concerning different types of offenses, the findings indicate that Pavela's (1997) model relating to four types of academic dishonesty requires expansion in order to explain the phenomenon in the digital era. Faculty should pay additional attention to the fabrication of data or arguments that were not identified in the protocols of the Disciplinary Committee analyzed in this study, although they were very common in a previous study among school students (Blau & Eshet-Alkalai, 2014, 2015). Regarding motivation for dishonesty, the findings support the Self-Concept Maintenance model (Mazar et al., 2008), showing students conduct dishonesty when they are still able to preserve themselves as honest people, despite their misbehavior. This finding might contribute to the development of effective policies and strategies for coping with academic dishonesty. Findings related to the penalties showed that penalties for analog dishonesty were more severe than those imposed for digital dishonesty. We recommend that Disciplinary Committee members should be aware of possible biases of perceiving digital dishonesty offenses as less severe than analog dishonesty offenses. Surprisingly, women were consistently penalized more severely than men, despite no significant gender differences in dishonesty types or in any other parameter explored in the study.

Limitations and Future Work

It should be taken into consideration that, although this study analyzes actual students' academic dishonesty in a large university during a period of a year and a half, it was conducted in one academic institution. Future studies might compare the data between different Israeli academic institutions and between universities in different countries. The method applied in the study of analyzing Disciplinary Committee rulings in an academic institution is an innovative research approach, and we hope that future studies will embrace it in order to shed light on the phenomenon and ways to prevent it.

References

Alroi-Stein, O. (2008). Cheapening of academic values in the age of the information and communication revolution. *Al Hagova, Academic Track at the College of Management, 7*, 56-57. [in Hebrew].

Ariely, D. (2012). *The (honest) truth about dishonesty*: How we lie to everyone – especially to ourselves. HarperCollins Publishers.

Blau, I., & Eshet-Alkalai, Y. (2014). *School students' perception of academic dishonesty with and without digital tools: Not acceptable, but common*. Paper presented at the International Conference on Advanced Education and Management - ICAEM2014. Beijing, China.

Blau, I., & Eshet-Alkalai, Y. (2015). *Cheating through digital technologies from the perspective of Israeli students, teachers and parents – Patterns and coping strategies.* Research report for the Chief Scientist Foundation, Ministry of Education. [in Hebrew]. Retrieved from http://ecat.education.gov.il/Attachment/DownloadFile?downloadId=5397

Blau, I., & Eshet-Alkalai, Y. (2016). How digital technologies affect academic dishonesty behavior of school students? In *Proceedings of the International Conference on Internet Studies – NETs2016.* Osaka, Japan.

Blau, I., Eshet-Alkalai, Y., & Rotem, I. (2014). Cheating and e-cheating: A qualitative investigation of expanding an academic dishonesty framework into digital learning settings. In *Proceedings of the 8th International Technology, Education and Development Conference - INTED2014* (p. 5002). Valencia, Spain.

Bretag, T. (Ed.), (2016). *Handbook of academic integrity* (pp. 7-21). SpringerNature: Springer Science-Business Media Singapore.

Brimble, M. (2016). Why students cheat: An exploration of the motivators of student academic dishonesty in Higher Education. In T. Bretag (Ed.), *Handbook of academic integrity* (pp. 365-382). Springer-Nature: Springer Science-Business Media Singapore.

Cheshin, Y. (2006). Academic integrity in institutions of higher education in Israel. *Al Hagova, Academic Track at the College of Management, 5*, 17-19. [in Hebrew].

Davies, L. J. P., & Howard, R. M. (2016). Plagiarism and the Internet: Fears, facts, and pedagogies. In T. Bretag (Ed.), *Handbook of academic integrity* (pp. 591-606). SpringerNature: Springer Science-Business Media Singapore.

Fishman, T. (2016). Academic integrity as an educational concept, concern, and movement in US institutions of higher learning. In T. Bretag (Ed.), *Handbook of academic integrity* (pp. 7-21). Springer-Nature: Springer Science-Business Media Singapore.

Friedman, A., Blau, I., & Eshet-Alkalai, Y. (2016). How and why students cheat? The role of technology in academic dishonesty and the penalties for conducting academic dishonesty. In *Proceedings of the 8th annual International Conference on Education and New Learning Technologies-EDULEARN2016,* Barcelona, Spain.

Jones, M., & Sheridan, L. (2015). Back translation: An emerging sophisticated cyber strategy to subvert advances in 'digital age' plagiarism detection and prevention. *Assessment & Evaluation in Higher Education*, *40*(5), 712-724.

Kauffman, Y., & Young, M. F. (2015). Digital plagiarism: An experimental study of the effect of instructional goals and copy-and-paste affordance. *Computers & Education*, *83*, 44-56.

Ledesma, R. G. (2011). Academic dishonesty among undergraduate students in a Korean university. *Research in World Economy, 2*(2), 25-35.

Mazar, N., Amir, O., & Ariely, D. (2008). The dishonesty of honest people: A theory of self-concept maintenance. *Journal of Marketing Research, 45*(6), 633-644.

Murdock, T. B., & Anderman, E. M. (2006). Motivational perspectives on student cheating: Toward an integrated model of academic dishonesty. *Educational Psychologist*, *41*(3), 129–145.

Newton, P. (2016). Academic integrity: A quantitative study of confidence and understanding in students at the start of their higher education. *Assessment & Evaluation in Higher Education*, *41*(3), 482-497.

Pavela, G. (1997). Applying the power of association on campus: A model code of academic integrity. *Journal of Business Ethics, 16*(1), 97-118.

Robinson-Zañartu, C., Peña, E. D., Cook-Morales, V., Peña, A. M., Afshani, R., & Nguyen, L. (2005). Academic crime and punishment: Faculty members' perception of and responses to plagiarism. *School Psychology Quarterly 20*(3), 318-337.

Rotem, I., Blau, I., & Eshet-Alkalai, Y. (2016). Academic dishonesty in the digital era: Perceptions and coping strategies of school teachers and parents. In *Proceedings of the Global Conference on Learning and Technology – Global Learn 2016.* Limerick, Ireland.

Shalvi, S., Gino, F., Barkan, R., & Ayal, S. (2015). Self-serving justifications: Doing wrong and feeling moral. *Current Direction in Psychological Science*, *24*(2), 125-130.

Steffensmeier, D., & Semuth, S. (2006). Does gender modify the effects of race–ethnicity on criminal sanctioning? Sentences for male and female white, black, and Hispanic defendants. *Journal of Quantitative Criminology, 22*, 241-261.

Stogner, J. M., Miller, B. L., & Marcum, C. D. (2013). Learning to e-cheat: A criminological test of Internet facilitated academic cheating. *Journal of Criminal Justice Education 24*(2), 175–199.

Sutherland-Smith, W. (2016). Authorship, ownership, and plagiarism in the Digital Age. In T. Bretag (Ed.), *Handbook of academic integrity* (pp. 575-589). SpringerNature: Springer Science-Business Media Singapore.

Whitley, B. E., & Keith-Speigel, P. (2002). *Academic dishonesty: An educator's guide.* Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Appendix: Encoding of Penalties

Penalty *	Encoding
Acquittal	0
Warning/reprimand	1
Invalidation of homework assignment/s	2
ILS 300 fine	3
Invalidation of exam	4
ILS 600 fine	5
Invalidation of paper	6
ILS 1,000 fine	7
Suspension for a semester	8
ILS 2,000 fine	9
Suspension for two semesters	10
ILS 3,000 fine	11
Suspension for three semesters	12
Invalidation of course	13
ILS 4,000 fine	14
Suspension for four semesters	15
ILS 5,000 fine	16
Suspension for five semesters	17
ILS 6,000 fine	18
Suspension for six semesters	19
ILS 7,000 fine	20
Suspension for seven semesters	21
ILS 8,000 fine	22
Suspension for eight semesters	23
Suspension for nine semesters	24
Suspension for ten semesters	25
Suspension for eleven semesters	26
Suspension for twelve semesters	27
Permanent suspension	40

*Note: If students were given more than one penalty, the severity was calculated as the sum of the codes for all penalties.

Biographies

Adi Friedman is a specialist in facilitating implementation and usage of educational technologies by faculty and students at the Open University of Israel. She is currently finishing her M.A. Thesis in Education, at the Graduate Program of Learning Technologies and Learning Systems, Department of Education and Psychology, the OUI. Her main research interest is preventing and coping with the phenomenon of academic dishonesty in academia.

Ina Blau is a Senior Lecturer in the Department of Education and Psychology, The Open University of Israel. She holds a PhD. in E-Learning and Cyber-Psychology. In 2011-2014 she was a lecturer in the Department of Information & Knowledge Management, Graduate School of Management, University of Haifa, and in 2015 was a Visiting Scholar in the National Institute of Education (NIE) and Learning Sciences Lab, Nanyang Technological University (NTU), Singapore. Dr. Blau has diverse experience in teaching, educational management, and teacher professional development related to technology-enhanced teaching and e-learning. She is a Member of the Digital Learning committee, the Israeli Council for Higher Education. Her research interests and publications focus on social aspects of e-communication and e-leadership; integration of innovative technologies in K-12, academia, and organizations; mobile learning and interaction; digital literacy skills; the effect of "productive failure" experience on the development of creativity; psychological ownership in e-collaboration; and online privacy in social networking. She led large-scale research projects which were supported by research grants from the Israeli Ministry of Education and focused on the phenomenon of digital cheating and plagiarism from the perspective of Israeli pupils, teachers, and parents, and on processes and outcomes of one-to-one computing in schools.

Yoram Eshet-Alkalai is a Professor at the Open University of Israel, Department of Education & Psychology, and the Head of the M.A. Program in Learning Technologies & Learning Systems. His major research and publications focus on digital literacy, digital reading, on human-computer interaction, and on the cognitive aspects of working with digital technologies. He studies the effect of technologies on a wide range of subjects, such as academic dishonesty, gaming, and friendship. Prof. Eshet-Alkalai has a diverse academic and professional background, including a B.A in Archeology, an M.Sc. in Geology, and a PhD in Earth & Environmental Sciences. For over a decade, he worked as a chief scientist in a computer company, designing and developing computer-based learning environments for the education systems in Israel and the USA. Prof. Eshet-Alkalai was also the Head of the Instructional Design Program at Tel Hai Academic College, and for 15 years served as a senior researcher at the Geological Survey of Israel. He is also the founder and formerly the Head of the Research Center for Innovation in Learning Technologies, The Open University of Israel.

This page left blank intentionally

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Gafni, R., & Nagar, I. (2016). CAPTCHA: Impact on user experience of users with learning disabilities. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 207-223. Retrieved from http://www.informingscience.org/Publications/3612

CAPTCHA: Impact on User Experience of Users with Learning Disabilities

Ruti Gafni and Idan Nagar
The Academic College of Tel-Aviv–Yaffo, Yaffo, Israel

rutigafn@mta.ac.il; Idan.nagar@gmail.com

Abstract

CAPTCHA is one of the most common solutions to check if the user trying to enter a Website is a real person or an automated piece of software. This challenge-response test, implemented in many Internet Websites, emphasizes the gaps between accessibility and security on the Internet, as it poses an obstacle for the learning-impaired in the reading and comprehension of what is presented in the test. Various types of CAPTCHA tests have been developed in order to address accessibility and security issues. The objective of this study is to investigate how the differences between various CAPTCHA tests affect user experience among populations with and without learning disabilities. A questionnaire accompanied by experiencing five different tests was administered to 212 users, 60 of them with learning disabilities. Response rates for each test and levels of success were collected automatically. Findings suggest that users with learning disabilities have more difficulties in solving the tests, especially those with distorted texts, have more negative attitudes towards the CAPTCHA tests, but the response time has no statistical difference from users without learning disabilities. These insights can help to develop and implement solutions suitable for many users and especially for population with learning disabilities.

Keywords: CAPTCHA, cyber security, user experience, learning disabilities, dyslexia

Introduction

Malicious programs try to access Websites for many reasons. One of the main issues of cyber security deals with the question whether the agent trying to reach a Website is a real person or a malicious automated program ("bot"). One of the most common solutions to decide whether the agent trying to access the Website is legal is called CAPTCHA (**C**ompletely **A**utomated **P**ublic **T**uring test to tell **C**omputers and **H**umans **A**part). The first CAPTCHA test was invented by Luis von Ahn, Manuel Blum, Nicholas Hopper, and John Langford of Carnegie Mellon University in 2000 and is still used today (Singh & Pal, 2014). The "T" in the name stands for "Turing Test to Tell", because CAPTCHA tests are like Turing Tests. In the original Turing Test, a human judge was instructed to ask a series of questions to two players, without seeing them, one of which was a computer and the other a human. Both players pretended to be the human, and the judge had to distinguish between them. CAPTCHA tests are similar to the Turing Test in that they distinguish humans from computers, but they differ in that the judge is now a computer (Von Ahn, Blum, & Langford,

Editor: Janice Whatley

An earlier, shorter version of this paper was presented at the Chais conference 2016, in Raanana, Israel, and included in Y. Eshet-Alkalai, I. Blau, A. Caspi, N. Geri, Y. Kalman, & V. Silber-Varod (Eds.), *Proceedings of the 11th Chais Conference for the Study of Innovation and Learning Technologies 2016: Learning in the Technological Era*. Raanana: The Open University of Israel.

2004). Using the CAPTCHA tests can prevent instances of spam in blogs, protect Website registrations, protect Email addresses from scrapers, prevent attacks, etc., while ensuring that those who enter the Website are only human people. The test performs a challenge-response authentication process, presenting a challenge to the user, and the right to access the Website is given if solved. If the user fails to solve the test then he/she is considered to be a machine, otherwise the user is considered as an authentic human being user, and the access is allowed. The user must use cognitive abilities, which are at the present time impossible for machines (Saini & Bala, 2013).

Cyber threats became abundant, and the attempts to reach computers by unauthorized agents are growing. Therefore, CAPTCHA implementations can be found on more than 3.5 million sites globally, in all kinds of Websites, like sites for fill-in forms, write comments, buy tickets, etc., and human beings solve CAPTCHA tests more than 300 million times a day (Angre, Kapadia, & Ugale, 2015). Moreover, companies and researchers are looking forward to replacing passwords with CAPTCHA tests, expanding even more the usage of CAPTCHA (Hande, & Ali, 2015; Reddy, Krishna, & Reddy, 2015).

The conflict between approachability and protection in the internet world is a complex issue, dealing with the necessity to allow a wide range of different users to access the desired Website, but preventing the access of malicious elements. CAPTCHA tests are an efficient approach to this goal, but are difficult for users with learning disabilities (LD), who have difficulties in reading, understanding, and performing the tests. CAPTCHA tests must be, on the one hand, very easy for the user in order to pass, and, on the other hand, very difficult for the bots to pass.

There are some definitions of Learning Disabilities, which were first defined by Hammill (1990). Since then, the definition was developed and re-defined. According to Katchergin (2015), researchers and professionals in the field of disabilities tend to base their definitions on those of the NJCLD (National Joint Committee on Learning Disabilities, 1994). The NJCLD definition claims that "Learning Disabilities" is a general term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical skills. These disorders are intrinsic to the individual, presumed to be due to central nervous system dysfunction. The number of people with learning disabilities in the population is not known exactly, but the numbers used by the professionals varied from 3% to 30%, with the most frequent estimate being 10% (Katchergin, 2015). Sometimes this percentage can be higher in practice, and it is even estimated that one-third of internet users suffer from certain symptoms of learning disabilities (McCarthy & Swierenga, 2010). According to the study of Foley (2012), the most common learning disability is dyslexia. Dyslexia (from Greek, dys=difficulty + lexis=words), also known as reading disorder, is a learning disability characterized by trouble reading despite one's normal intelligence. A dyslexic person has difficulty in associating the graphic symbols and letters with their corresponding sounds and cannot organize them mentally in a correct sequence (Madeira, Silva, Marcelino, & Ferreira, 2015). Different people are affected to varying degrees. Problems may include sounding out words, spelling words, reading quickly, writing words, pronouncing words when reading aloud, and understanding what one reads. Often these difficulties are first noticed at school. The cause of dyslexia is believed to involve both genetic and environmental factors. It occurs most often in people with attention deficit hyperactivity disorder (ADHD) and is associated with problems with mathematics. The underlying mechanism involves problems with the brain's processing of language. Dyslexia is diagnosed by a series of tests of a person's memory, spelling, ability to see, and reading skills. It is separate from reading difficulties due to poor teaching, or hearing or vision problems (Katchergin, 2015).

People with learning disabilities may find it difficult and disturbing to succeed in performing the CAPTCHA tests, because they consist in combining cognitive and physical effort. They must read distorted texts, understand them, perform calculations, and even move small pictures with accuracy.

Many studies have been conducted on CAPTCHA, focusing on the security analysis (Azad, 2013), on the differences between types of tests (Foley, 2012; Singh & Pal, 2014), and examining the combination between security and user friendliness (Gossweiler, Kamvar, & Baluja, 2009). Only few focused on the user experience (Fidas, Voyiatzis, & Avour, 2011; Tangmanee & Sujarit-apirak, 2013). This research deals with the influence of CAPTCHA tests among users having learning disabilities, examining user experience, actual performance, and success.

Theoretical Background

User Disabilities, Accessibility, and User Experience

Bevan's (2009) study describes the user experience as including emotions, beliefs, preferences, conceptions, psychological and physical reactions, behaviors, and achievements occurring before, during, and after usage. According to Onwudebelu, Sanjo, Obi, and Alaba (2010), the use of CAPTCHA tests is a nuisance. Some users feel threatened by these tests, irritated, and frustrated, as they are unable to understand the need for it. Others reported that the text displayed is unclear, and they struggle to solve it. Most reported the tests slow them down and interfere with their activity on Websites.

Web accessibility has become an important issue since the dramatic rise in the use of the Internet. Web accessibility deals with overcoming barriers, which users with disabilities face when trying to access information on Websites. In some countries (U.S.A., Israel, etc.) laws relating to Internet accessibility were legislated, in order to improve the usability of the Internet for disabled users. However, a large number of Websites are still not adapted. For example, nearly a third of the official government Web sites of the 50 states and the District of Columbia tested did not meet the most fundamental requirements for Web accessibility (White, Goette, & Young, 2005). There are many recommendations for development of appropriate and friendly Websites that need to be accessible towards those users, and in this way improve the experience for internet users (McCarthy & Swierenga, 2010; Pascual, Ribera, & Granollers, 2015), including guidelines (W3C, 2008) and clear principles (Matej, 2013). These recommendations help and encourage designers and web developers to make Websites accessible to all users, including users with disabilities and impairments (Foley, 2012). The Internet may greatly facilitate the provision of accessible information to people with learning disabilities. However, problems of navigation and, therefore, retrieval represent a barrier for this cohort. A study conducted by Williams and Hennig (2015) examined how the Web-page design affects the access to content for people with learning disabilities. For example, they examined whether the orientation of the page, vertical or horizontal, and the positions of the words in the page facilitate faster access. They found that the propensity to imbibe information "serially" (word-for-word) rather than to skim or look "globally" has important Website design implications. According to Sagirani, Nugroho, Santosa, and Kumara (2015) there are some recommendations and basic concepts in creating a design that can foster user experience. Planning the product should focus on the content, presentation, functionality, and interaction. Specifically, good interaction between users with limitations and the application can provide improvements for children with special educational needs, especially on their cognition, emotion, motivation, attention, perception, and behavior. Aside from accessibility difficulties, frustration, and poor user experience (Ghazarian, 2014), user abandonment and decline in the website's conversion rates (the percentage of visitors who take a desired action) are additional consequences of CAPTCHA tests suffering from user-unfriendliness (Mujumdar & Polisetti, 2011).

The activity of CAPTCHA tests needs to be trivial enough to be performed successfully by human persons, but they often present some difficulties (Singh & Pal, 2014). Each of the different types has some drawbacks.

Types of CAPTCHA Tests

During the last years, several types of CAPTCHA tests have been defined and developed. Each type has its pros and cons. Here are the descriptions of the most common types of CAPTCHA tests:

Text-based CAPTCHA test – is the most used kind of test (Figure 1), called "reCAPTCHA", consisting of a sequence of numbers and letters, twisted and shown in a distorted manner. This mechanism was originally aimed to help digitize printed text that was hard to read for OCR (Optical Character Recognition) and was acquired by Google in 2009, in order to digitize antique manuscripts ("reCAPTCHA", n.d.). The user needs to identify and decipher what is shown and then type the exact sequence into a text box. If the user cannot decipher the text, it is possible to retry with a different text. There is also an option to hear the letters, which was developed for vision-impaired people. The user hears a sequence of letters and/or numbers and must type the sequence in the text-box, but this is often performed with a noisy background, which does not help too much.

Figure 1. Text-based CAPTCHA

In 2013, reCAPTCHA began implementing behavioral analysis of the browser's interactions with CAPTCHA. This analysis (Figure 2) occurs before displaying the CAPTCHA and presents a more difficult test in cases there are reasons to think the user is a bot. From 2014 this mechanism, called **"No CAPTCHA reCAPTCHA"**, started to be used in most of Google services ("reCAPTCHA", n.d.).

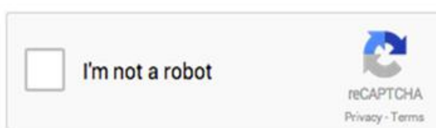


Figure 2. No CAPTCHA reCAPTCHA

Arithmetic operation based CAPTCHA test – contains a very basic arithmetic operation, for example "1+3 =" (Figure 3), which can be performed by almost every human being. The user needs to enter the result of the operation into a text box.

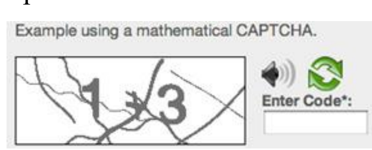


Figure 3. Arithmetic operation CAPTCHA

Picture based CAPTCHA test – in this kind of test, a number of pictures are shown to the user with a simple question. In the example shown in Figure 4, there are eight different pictures, of which four show “piggy banks”. The user is asked to click on all of the piggy bank images. The user must identify the pictures and select those which represent the correct answer, and there is no need to write any text. There are some variations of the picture-based CAPTCHA, for example, sliding distorted pictures to arrange them (Figure 5).

Figure 4. Picture based CAPTCHA

Figure 5. Sliding picture based CAPTCHA
(from http://www.geekandblogger.com)

Game based CAPTCHA test – includes puzzles or interactive games (Mohamed et al., 2013). User experience and gamification are some of the “buzzwords” in the last years (Robson, Plangger, Kietzmann, McCarthy, & Pitt, 2015). In order to encourage the users to perform tedious but substantial tasks, the activity is wrapped with a joyful function. In Figure 6, an example of a game can be seen, where the user needs to drag the pictures of items that are food to the baby’s mouth.

Figure 6. Game based CAPTCHA

CAPTCHA Tests and Users with Disabilities

In the text-based CAPTCHA test, the user experiences difficulties deciphering and identifying the characters due to the blurring of the characters displayed and their distortion. According to Foley’s study (2012), the text-based CAPTCHA test has many accessibility problems. For example, visually impaired or almost blind users find the distorted text difficult to decipher, and sometimes even completely impossible to see. This means that they are not able to pass this test. For people with dyslexia, the ability to read and understand text can be affected by the way in which text has been written and produced, therefore, users with learning disabilities might also find it difficult to identify correctly the characters displayed in this test, which in turn will cause them to fail the test as well. Hsu and Lee (2011) found that older users show greater difficulty in passing a text-based CAPTCHA in comparison to younger users, and that even non-disabled users may encounter difficulties recognizing and understanding the distorted characters. Bursztein, Bethard, Fabry, Mitchell, and Jurafski (2010) found that the response times of older users were longer, while they made fewer mistakes. Furthermore, a “bot” can have the ability to recognize the character sequence using Optical Character Recognition (OCR) software. In order to prevent access from bots, Azad (2013) suggested to raise the security of text -based CAPTCHA by adding “noise”, increasing the level of distortion of the characters and aligning the characters more closely; yet, this would make it more difficult for users to identify the characters, causing more mistakes.

Mostly, CAPTCHA tests require the deciphering of a sequence of deformed characters in Latin letters. This means that the text-based CAPTCHA test, the most common type being used today, requires that users be able to know and read Latin letters. For Thai internet users, English is a less familiar language, so for them, tests in Thai could prove to be a more suitable option. Tangmanee and Sujarit-apirak (2013) claimed that Thai users are well aware of the existence of CAPTCHA, but prefer an application using Thai language, which they are more familiar with. The study of Fidas et al. (2011), explains that Greek users have also experienced difficulties using CAPTCHA. Users whose mother tongue is not written in Latin letters frequently find CAPTCHA more challenging. Some CAPTCHA tests were defined in other languages, for example, in Arabic and Persian (Shirali-Shahreza, & Shirali-Shahreza, 2006).

In the audio-based type, the sound clips played are based on the English language, and therefore the user must understand English; in addition, there is a problematic side to recognizing similar-sounding letters. Moreover, the text is played together with “noise”, in order to pose a challenge to “bots”, and that makes this solution less than ideal as it poses a problem for users who have a hearing impairment or suffer from hearing loss, which, according to the World Health Organization, consists of more than 5% of the population (WHO, 2015). According to Onwudebelu et al., (2010), while audio-based CAPTCHA tests are more commonly used for the visually impaired, they do not provide full accessibility and are even characterized by a lower degree of security.

Picture-based CAPTCHA tests require recognition and selection of images with a similar or an exceptional meaning or out of a sequence of images and may cause confusion, as the images can sometimes be interpreted as having different meanings (Ahn, Kim, & Kim, 2013). Some studies propose variations of the tests, in order to simplify them, but these propositions are not widely used yet (Ahn et al., 2013; Gossweiler et al., 2009). Picture-based CAPTCHA tests do not pose many of the problems faced by users with learning disabilities; however, in these tests, visually impaired users still come across challenges similar to those of the text-based tests and struggle to pass the tests (Foley, 2012).

Preliminary results of the study of Madeira et al., (2015), dealing with mobile applications’ usability for dyslexic users, show that a gamified set of activities allow dyslexics to improve multi-sensory perception, constituting an added value facilitator of adaptiveness and learning. Thus, game-based CAPTCHA tests may be the best choice for these users.

CAPTCHA tests must be easy for the user to pass successfully and be sufficiently difficult to prevent the “bots” from passing them. However, most studies focus primarily on how to make the tests more difficult for bots, in response to the growing number of security threats.

The CAPTCHA test supposedly provides an efficient method to distinguish between real users and “bots”. However, the extensive use of CAPTCHA actually impairs the experience of users with disabilities, and using this method is not the ideal solution in the long-term (Onwudebelu et al., 2010). It emphasizes the gap between accessibility and security on the Internet, as it poses an obstacle and a significant challenge for the visually impaired or learning-impaired in the reading and comprehension of what is presented in the test, seeing that it provides significant challenges to users who have impaired vision or have learning disabilities.

Research Questions and Hypotheses

The objective of this study is to investigate the differences between various CAPTCHA tests and examine how they affect user experience among populations with and without learning disabilities. For this purpose three questions were examined in the study.

People with learning disabilities find it difficult to read regular text, so reading and deciphering distorted letters (Foley, 2012; Hammill, 1990; Katchergin, 2015), such as in the Text-based or Arithmetic based CAPTCHA test, will prolong their efforts in reading, and therefore the response time may be longer. However, gamification of the test may be an easier task for users with learning disabilities (Madeira et al., 2015), taking less time to perform it. Thus, the first research question and its hypothesis are:

> RQ1: Are there any differences in the response time of users with or without learning disabilities?
>
> *H1: The performance time of users with learning disabilities will be longer in text and arithmetic based tests*

The difficulties that users with learning disabilities need to cope with may cause frustration and decrease motivation (Katchergin, 2015; McCarthy & Swierenga, 2010), therefore it may result in failures. However, when using CAPTCHA tests that are not based on letters and numbers, their performance may be higher (Madeira et al., 2015). Thus, the next research question has two complementary hypotheses:

> RQ2: Are there any differences in the success rate of users with or without learning disabilities?
>
> *H2.1: The success rate of users without learning disabilities will be greater.*
>
> *H2.2: Users with learning disabilities will succeed better in tests, which do not include letters.*

According to prior studies, users found it annoying to perform the CAPTCHA tests (Onwudebelu et al., 2010). Those users with learning disabilities will find these tests more frustrating. However, their attitude may be better with the Picture and Game based tests, because in these tests the text parts are smaller and not distorted. Therefore, the third research question has two hypotheses:

> RQ3: Are there any differences in the attitude and user experience of users with or without learning disabilities?
>
> *H3.1: Attitude and user experience of users with learning disabilities will be more negative.*
>
> *H3.2: Users with learning disabilities will report better experience in tests, which do not include letters.*

Methodology

The data for this study was collected using an experiment, which was embedded into a questionnaire.

The first part of the questionnaire was composed of 11 demographic and general information questions. The next five parts, each dealt with one of the following CAPTCHA tests:

1. Text-based CAPTCHA
2. Arithmetic operation-based CAPTCHA
3. Picture-based CAPTCHA, using the version with the slider option, developed by Minteye Company (www.minteye.com)
4. Game-based CAPTCHA, developed by Are-you-a-human Company (www.areyouahuman.com)
5. "No CAPTCHA", developed by Google Company (www.google.com/recaptcha)

The participants were asked to actually perform and solve each test, and immediately after that to answer 10 questions about their experience using each one of the tests. The same questions were asked about each of the tests. The responses were based on a five-level Likert-type scale (1 – 'Strongly disagree', to 5 – 'Strongly agree'). Altogether, each participant answered 61 questions and performed 5 different tests.

While the participants tried to solve the tests, a specifically developed hidden script automatically accumulated the data about the success or failure of the respondent in using each test and the time it took to complete it.

The questionnaire and experiment, which were built as a single unit using a plug-in based on WordPress, which is a free and open-source web content management system, were delivered primarily via the Internet, both through social media like Facebook (Baltar & Brunet, 2012), and through Websites and forums related to learning disabilities.

The combination of both research methods was based on the study conducted by Abrich, Berbenetz, and Thrope (2011), which defined the quality of user experience on whether the user was correct or not when taking a test, as well as on the level of test difficulty the user reported.

The answers were collected during one week (December 2014), and then gathered and analyzed using IBM® SPSS® Statistics.

Results

In the first part of the questionnaire, the respondents had to give demographic data and information about their previous familiarity with the different CAPTCHA tests.

There were 212 respondents, 60 reporting having learning disabilities or thinking they have but not diagnosed yet (28%) and 152 without learning disabilities (72%).

The frequency of Internet usage was similar and high in the two groups (4.7 in LD and 4.88 in non-LD).

Table 1 supplies demographics descriptive statistics of the participants in the questionnaire and experiment.

Table 1: Demographics of the survey participants

N	212	
Gender	99 men 113 women	(47%) (53%)
Age	18 and under - 6 participants 19-30 – 141 participants 31-45 - 46 participants 46-59 - 14 participants 60 and above – 5 participants	(3%) (66%) (22%) (7%) (2%)
Education	21 - high school 118 - Undergraduate students 46 - Bachelor degree 27 - Master and higher degrees	(10%) (56%) (22%) (13%)

Table 2 summarizes the familiarity of the users (with and without learning difficulties) with each CAPTCHA test. The mean value and standard deviation are shown. As seen, the text-based CAPTCHA is the most familiar to the users, and the arithmetic operation based one is also known. Most of the users are not so familiar with the other three types.

Table 2. Familiarity with the CAPTCHA tests (1 – 'Never', 5 – 'Very often')

	CAPTCHA type	**LD users (n=60)**	**Non-LD users (n=152)**	**Total (n=212)**
1.	**Text based**	3.88 (1.01)	3.92 (0.94)	3.91 (0.96)
2.	**Arithmetic operation based**	2.48 (1.25)	2.19 (1.26)	2.28 (1.26)
3.	**Picture based**	1.03 (0.18)	1.2 (0.63)	1.15 (0.55)
4.	**Game based**	1.13 (0.5)	1.1 (0.43)	1.11 (0.45)
5.	**"NO CAPTCHA" based**	1.33 (0.88)	1.69 (1.13)	1.59 (1.08)

The general position of the respondents towards CAPTCHA, according to prior experiences and before the experiment was conducted, was collected by a set of statements, for which the participant had to rate his agreement on a Likert based scale. Table 3 summarizes the means for each statement, for the users with learning disabilities, for those without learning disabilities, and for the whole sample. As can be seen, the users understand the purpose of the tests (4.19), but this understanding does not cause them to feel protected (2.83). Moreover, most of the users do not like to use the CAPTCHA tests.

It is important to emphasize, that according to Table 2, most of the users are familiar only with the text-based and arithmetic-based tests. Moreover, there is a prominent difference between the two kinds of users for two types of CAPTCHA: users with learning disabilities are more familiar with arithmetic-based test, while they are less familiar with the latest type, the "NO CAPTCHA" test.

Table 3: General position towards CAPTCHA tests

Statement	LD users	Non-LD users	Total
"I understand the meaning and the purpose of CAPTCHA tests"	3.97	4.28	4.19
"I feel frustrated / I hate it"	3.32	2.94	3.05
"I feel that I spend too much time on it"	3.98	3.41	3.57
"I feel protected / safe"	2.95	2.79	2.83
"I prefer something more comfortable instead of this test / I prefer it would not exist"	3.83	3.64	3.70

Thereafter, the participants were asked to solve the first test and immediately answer some questions about their experience. This was done with the other four tests as well.

After performing each of the CAPTCHA tests, the participants were asked to rate their experience with the test, in terms of the extent to which they agree with the following statements:

1. The experience after the CAPTCHA test:

"How would you describe your feeling after taking this CAPTCHA test?"

Item 1.1: *"**Frustrating** – the test was **difficult and unclear**"*
Item 1.2: *"**A waste of time** – It took **too much time** to do it"*
Item 1.3: *"**Comfortable/Enjoyable** – It was a **nice** test"*

2. The position towards this CAPTCHA test:

"If you have to take this CAPTCHA test again, what will your position be towards this test?"

Item 2.1: *"I would rather do it again – since it's **easy and clear**"*
Item 2.2: *"I would rather do it again – since it takes only a **short time** to do it"*
Item 2.3: *"I would rather do it again – since it's **nice and comfortable**"*

3. The position towards the Website:

"If you have to take this CAPTCHA test again, what will your position be towards the Website that displays this test?"

Item 3.1: *"My position will be **positive**"*
Item 3.2: *"I will not cooperate with this site – **I will leave this site immediately**"*
Item 3.3: *"I will not cooperate with this site – **I will not perform actions** such as registration, buying, etc."*

The outputs of the respondents' experience are summarized in Table 4, which gives the items' means and standard deviation, the constructs built according to the statements, and their reliability, measured by Cronbach's alpha. Principal component factor analysis with Varimax rotation was used to examine construct validity. Three items were intended to comprise one factor, 'Unwillingness to use the Website', but one item (3.1) was statistically excluded. The 1.3 statement was intended to be included in the 'Frustrating' construct (negative), but it was found that it loaded a different factor. Finally, four constructs were defined: 'Frustrating', 'Enjoyable', 'Readiness for future use', and 'Unwillingness to use the Website'.

Table 4. User experience constructs definition

Item	Mean (SD)	Cronbach's alpha	Construct	Mean (SD)
1.1	3.94 (1.28)	.802	Frustrating	3.86 (1.23)
1.2	3.78 (1.40)			
1.3	2.94 (1.49)	Separated	Enjoyable	2.94 (1.49)
2.1	3.07 (1.48)	.954	Readiness for future use	3.05 (1.43)
2.2	3.09 (1.48)			
2.3	3.00 (1.52)			
3.1	2.89 (1.34)	Deleted		
3.2	4.29 (1.07)	.904	Unwillingness to use the Website	4.28 (1.03)
3.3	4.26 (1.09)			

The results (Table 5) indicate that there is a significant difference between users with learning disabilities and users without learning disabilities among the participants in two user experience constructs: 'Frustrating' and 'Unwillingness to use the Website'.

Table 5. Statistical results of User experience

User Experience construct	LD User	N	Mean	SD	T	df	Sig. (2-tailed)
Frustrating	No LD	760	3.96	1.19	3.961	508.79	.000
	LD	300	3.62	1.29			
Enjoyable	No LD	760	2.95	1.49	.412	1058	.680
	LD	300	2.91	1.50			
Readiness for future use	No LD	760	3.07	1.43	.627	1058	.531
	LD	300	3.01	1.43			
Unwillingness to use the Website	No LD	760	4.34	0.96	3.123	463.18	.002
	LD	300	4.10	1.18			

Table 6 summarizes the findings of the user experience of each of the CAPTCHA tests, according to the constructs defined. The gamed-based CAPTCHA was found to be the most enjoyable for users with learning disabilities, while the text-based was the least enjoyable and most frustrating.

Statistical differences between the group of users with learning disabilities and the group of users without were found in the 'Frustrating' construct in the text-based ($t = -2.36$, $df = 210$, $sig = 0.019$) and arithmetic-operation-based ($t = -3.294$, $df = 210$, $sig = 0.001$) tests.

Table 6. Comparison of means and sd - user experience for CAPTCHA types

CAPTCHA type	LD User	Post-test experience			
		Frustrating	Enjoyable	Readiness for future use	Unwillingness to use the Website
1. Text based	No LD	3.56 (1.10)	2.05 (1.17)	2.42 (1.12)	4.30 (0.87)
	LD	3.15 (1.17)	1.85 (1.15)	2.09 (1.04)	4.98 (1.03)
2. Arithmetic operation based	No LD	4.52 (1.03)	3.01 (1.47)	3.30 (1.42)	4.45 (0.85)
	LD	4.69 (1.20)	2.72 (1.28)	3.07 (1.27)	4.11 (1.26)
3. Picture based	No LD	3.94 (1.15)	3.34 (1.42)	3.31(1.44)	4.37 (0.95)
	LD	3.68 (1.36)	3.22 (1.52)	3.26 (1.51)	4.17 (1.19)
4. Game based	No LD	3.86 (1.21)	3.24 (1.38)	3.07 (1.37)	4.30 (0.97)
	LD	3.68 (1.23)	3.55 (1.47)	3.19 (1.39)	4.29 (1.13)
5. "NO CAPTCHA" based	No LD	4.20 (1.31)	3.11 (1.63)	3.24 (1.56)	4.28 (1.13)
	LD	3.88 (1.42)	3.20 (1.49)	3.44 (1.53)	3.98 (1.27)

As mention in the methodology section, each time the participant performed a test, two inputs were collected automatically: the response time to complete the test, and the output, to check if the test was performed successfully or if the answer was wrong.

As for response time, surprisingly, there were no significant differences between users with learning disabilities and those participants without learning disabilities for any of the CAPTCHA tests (Table 7).

Table 7. Comparison of the CAPTCHA types – Response Time

CAPTCHA type	Response Time (in seconds)					
	Mean (SD)		Median			
	LD users (n=60)	Non-LD users (n=152)	LD users (n=60)	Non-LD users (n=152)	t-test	Sig (2-tailed)
1. Text based	22.25 (12.73)	19.36 (13.69)	18	16	-1.41	0.16
2. Arithmetic operation based	11.4 (10.85)	9.16 (8.3)	9	8	-1.61	0.11
3. Picture based	26.78 (29.53)	24.34 (23.55)	18	18.5	-0.63	0.53
4. Game based	21.07 (13.05)	20.34 (16.33)	17	17	-0.31	0.76
5. "NO CAPTCHA" based	19.32 (22.74)	18.97 (23.6)	11.5	13	-0.10	0.92

The success rate was calculated for each test. Table 8 presents the results and the statistical comparison, using the Pearson Chi-square test ($p < 0.05$), indicating that there is a significant dependence between the test success and the existence of LD only for text -based CAPTCHA, bringing the LD users to fail more often. The arithmetic test is more difficult for all populations.

Table 8. Comparison of the CAPTCHA types – Success Rates

CAPTCHA type	Success Rate	LD users (n=60)	Non-LD users (n=152)	χ^2 value	df	Sig. (2-tailed)
1. Text based	%	58.33%	74.34%			
	Pass	35	113	5.23	1	0.022
	Fail	25	39			
2. Arithmetic operation based	%	48.33%	50%			
	Pass	29	76	0.048	1	0.83
	Fail	31	76			
3. Picture based	%	68.33%	73.03%			
	Pass	41	111	0.47	1	0.49
	Fail	19	41			
4. Game based	%	83.33%	82.89%			
	Pass	50	126	0.01	1	0.96
	Fail	10	26			
5. "NO CAPTCHA" based	%	86.67%	89.47%			
	Pass	52	136	0.34	1	0.56
	Fail	8	16			

Discussion

Findings suggest that users with learning disabilities have more difficulties in solving the tests, especially those with distorted texts, and have more negative attitudes towards the CAPTCHA tests than other users. Surprisingly, there was no significant difference found in response times, between users with learning disabilities and those without in any of the five test types, thus, rejecting H1, which claimed that "The performance time of users with learning disabilities will be longer in text and arithmetic based tests". The reason H1 was not supported may be the fact that CAPTCHA tests have become so common that the users are getting used to the twisted letters. Another reason for this finding may be due to a certain level of impulsiveness in users with learning disabilities. According to estimates done on children with dyslexia, 30% have at least a mild form of ADHD, which is characterized by hyperactivity, inattentive and impulsive behavior (Lee, 2015).

However, a significant difference was found in the test success rates between the two kinds of users for only the text-based CAPTCHA. In all other types of CAPTCHA there were no differences between the groups. Thus, H2.1, claiming that 'The success rate of users without learning disabilities will be greater' was partially rejected, supporting the position of Hsu & Lee (2011), who claim that even the non-impaired population might encounter difficulties with CAPTCHA tests. Their study was one of the first to examine CAPTCHA tests from the users' perspective. These findings, in fact, confirm the widespread notion that CAPTCHA tests are difficult for people.

In addition, H2.2 which claims that 'Users with learning disabilities will succeed better in tests, which do not include letters' was accepted, meaning that users with learning disabilities have more difficulties in reading the distorted texts, supporting Foley's study (2012), but they have no problems performing other tasks. Perhaps, if those users had spent more time to resolve the test, the success rate would have been better, in spite of their learning disabilities.

A significant difference in the user-experience attitude was found for 'Frustrating' and 'Unwillingness to use the Website' between users with learning disabilities and the those without, where users with learning disabilities had a more negative attitude towards the tests, accepting H3.1, which claims that 'Attitude and user experience of users with learning disabilities will be more negative'. The most negative attitude of the users with learning disabilities was found in the text-based and arithmetic-based CAPTCHA, supporting H3.2, which claims that 'Users with learning disabilities will report better experience in tests, which do not include letters'.

Conclusions

The main conclusion of this research is that all five types of tests influenced user experience to a certain degree, from frustration to enjoyment. Users with learning disabilities found it more difficult to succeed in the text-based CAPTCHA, and there was a significant difference found between participants with learning disabilities and those without learning disabilities in most users' experiences constructs examined.

According to the International Dyslexia Association (International Dyslexia Association, n.d.), overcoming dyslexia and other learning difficulties can be achieved through multisensory re-education, which involves the use of visual, auditory, and kinesthetic-tactile pathways simultaneously in order to enhance memory and written language learning. The Web is a very useful tool for individuals with disabilities. Therefore, it is important for organizations to design Web sites that are accessible by all kinds of individuals. The Internet helps improve the life of individuals with disabilities, and Web accessibility can improve the experience of these populations. In order to create accessible Web sites, Web developers need to follow the guidelines set by the W3C (2008). It is easier to develop an accessible site from scratch, than to improve an existing one (White et al., 2005). Accordingly, designing CAPTCHA tests adapted for users with learning disabilities is necessary.

It appears that appropriate and careful reference to the findings and conclusions of this research on the part of user experience experts, developers, and web designers can lead in the future to applying solutions that are more suitable for many users and especially for populations with learning disabilities. Such solutions could benefit significantly the accessibility of the Internet and improve the user experience on many Websites.

As described, the game-based CAPTCHA tests may be the best choice for users with learning disabilities. Still, it should be noted that visually impaired users might take more time to solve a test of this type.

The solution chosen by the developers of the Website must take into consideration, on the one hand, the security level needed and, on the other hand, the user experience and frustration in solving the test.

Limitations and Further Research

The main limitations of this study are the following:

(1) The small number of participants with learning disabilities compared with those without (60 with LD, and 152 without). A larger number of users with learning disabilities might have provided a better representative sample.

(2) The definition of users with learning disabilities – some were diagnosed, some were self-reported, but not diagnosed, and others may be not aware of having learning disabilities.

Further research is needed, especially for the "No CAPTCHA" test, where findings were unclear. This test seems obvious and easy to perform, for all the population, regardless of any disability. For instance, it would be good to examine separately how many users were presented with an additional task to complete after this test, and in which cases it is being used.

Another recommendation for future research would be to examine the influence of different devices in solving CAPTCHA tests, e.g., through mobile phones or computers, on performance and especially on user experience. It may be found, that performing those tests on touch-screens, like in smartphones and tablets, are easier than on a desk-computer, in which a keyboard and a mouse must be used. However, if typing is needed, a larger screen and keyboard may be more comfortable for users with learning disabilities. A study about CAPTCHA tests has been recently conducted, using Nielsen's heuristic evaluation (Reynaga, Chiasson, & van Oorschot, 2015). Their research's aim was to propose and validate a set of heuristics for evaluating CAPTCHA schemes on smartphones. However, they did not investigate the issue among specific sensitive populations, in the way suggested here.

References

Abrich, R., Berbenetz, V., & Thorpe, M. (2011). *Distinguishing between humans and robots on the Web.* Retrieved December 1, 2014, from http://richardabrich.com/abrich-berbenetz-thorpe_thecaptchaexperiment.pdf

Ahn, Y., Kim, N., & Kim, Y. S. (2013). A user- friendly image-text fusion CAPTCHA for secure web services. In *Proceedings of International Conference on Information Integration and Web-based Applications & Services*, 550-554.

Angre, A. R., Kapadia, M. D., & Ugale, M. (2015). PiCAPTion: Picture CAPTCHAs for internet authentication*. International Journal of Computer Applications*, *114*(10).

Azad, K. J. (2013). CAPTCHA: Attacks and weaknesses against OCR technology. *Global Journal of Computer Science and Technology, 13*(3).

Baltar, F., & Brunet, I. (2012). Social research 2.0: Virtual snowball sampling method using Facebook. *Internet Research, 22(1*), 57-74.

Bevan, N. (2009). What is the difference between the purpose of usability and user experience evaluation methods*. UXEM'09 Workshop*, Upssala, Sweden.

Bursztein, E., Bethard, S., Fabry, C., Mitchell, J. C., & Jurafsky, D. (2010). How good are humans at solving CAPTCHAs? A large scale evaluation. In *Security and Privacy (SP), Symposium on Security and Privacy IEEE*, 399-413.

Fidas, C., Voyiatzis, A., & Avouris, N. (2011). On the necessity of user-friendly CAPTCHA. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 2623-2626.

Foley, A. (2012). *Biometric alternatives to CAPTCHA: Exploring accessible interface options.* Masters Dissertation, Dublin Institute of Technology, Ireland.

Ghazarian, A. (2014). *CAPTCHAs' effect on UX and how to fix it.* Retrieved December 15, 2014, from DesignModo: http://designmodo.com/ux-captcha-effect

Gossweiler, R., Kamvar, M., & Baluja, S. (2009). What's up CAPTCHA? A CAPTCHA based on image orientation. In *Proceedings of the 18th international conference on WWW*, 841-850.

Hammill, D. D. (1990). On defining learning disabilities: An emerging consensus. *Journal of learning Disabilities*, *23*(2), 74-84.

Hande, S. G., & Ali, M. S. (2015). Enhancing the security using CAPTCHA as a graphical password. *International Journal* of *Advance Research in Computer Science and Management Studies, 3*(4), 346-352.

Hsu, C.-H., & Lee, Y. -L. (2011). Effects of age groups and distortion types on text-based CAPTCHA tasks. In J. A. Jacko (Ed.), *Human-computer interaction. Users and Applications* (pp. 435-455). New York: Springer-Verlag Berlin Heidelberg publications.

International Dyslexia Association. (n.d.). *Multisensory structured language teaching*. Retrieved June 7, 2016, from: http://eida.org/multisensory-structured-language-teaching/

Katchergin, O. (2015). How many learning disabled are there? The rhetorical power of statistics in the Israeli discourse on learning disabilities. *Open Journal of Social Sciences, 3*(09), 155-166.

Lee, R. (2015). Dyslexia font simulates how it's like to read if you're dyslexic. *TechTimes.* Retrieved June 9, 2016, from http://www.techtimes.com/articles/58567/20150608/dyslexia-font-simulates-how-its-like-to-read-if-youre-dyslexic.htm

Madeira, J., Silva, C., Marcelino, L., & Ferreira, P. (2015). Assistive mobile applications for dyslexia. *Procedia Computer Science, 64,* 417-424.

Matej, S. (2013). *Strict standards: Introduction to CAPTCHA accessibility.* Retrieved June 1, 2014, from CAPTCHA.com: http://captcha.com/captcha-accessibility.html

McCarthy, J. E., & Swierenga, S. J. (2010). What we know about dyslexia and web accessibility: A research review. *Universal Access in the Information Society, 9*, 147-152.

Mohamed, M., Sachdeva, N., Georgescu, M., Gao, S., Saxena, N., Zhang, C., & Chen, W. B. (2013). *Three-way dissection of a game-CAPTCHA: Automated attacks, relay attacks, and usability.* Cornell University. New York: arXiv:1310.1540.

Mujumdar, D., & Polisetti, S. (2011). *A platform to monetize usable & secure CAPTCHAs for desktop and mobile devices (PICATCHA).* Retrieved Dec 20, 2014, from Kevinwarnock: http://www.kevinwarnock.com/wp-content/uploads/2012/05/picatcha_mims_final_report_summary_0.pdf

National Joint Committee on Learning Disabilities (NJCLD). (1994). Learning disabilities: Issues on definition-revised. In NJCLD (Ed.), *Collective perspectives on issues affecting learning disabilities* (pp. 61-66). Austin, TX: Pro-Ed.

Onwudebelu, U., Sanjo, F., Obi, N. C., & Alaba, O. B. (2010). CAPTCHA malaise: Users suffer consequences of the anti-spam technology while the spammers adapt. In *Proceeding of the 1st International Conference and Workshop on Software Engineering and Intelligent Systems*, 113-125.

Pascual, A., Ribera, M., & Granollers, T. (2015). Impact of web accessibility barriers on users with a hearing impairment. *Dyna, 82*(193), 233-240.

ReCAPTCHA. (n.d.). In Wikipedia. Retrieved May 8, 2016, from https://en.wikipedia.org/wiki/ReCAPTCHA

Reddy, K. V., Krishna, D. S. R., & Reddy, D. J. (2015). CAPTCHA and its techniques for providing security in web and applications. *International Journal of Research, 2*(8), 815-821.

Reynaga, G., Chiasson, S., & van Oorschot, P. C. (2015). Heuristics for the evaluation of CAPTCHAs on smartphones. In *Proceedings of the 2015 British HCI Conference,* ACM 126-135.

Robson, K., Plangger, K., Kietzmann, J. H., McCarthy, I., & Pitt, L. (2015). Is it all a game? Understanding the principles of gamification. *Business Horizons, 58*(4), 411-420

Sagirani, T., Nugroho, L. E., Santosa, P. I., & Kumara, A. (2015). User experience model in the interaction between children with special educational needs and learning media. In *2015 2nd International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE)* (pp. 72-75). IEEE.

Saini, B. S., & Bala, A. (2013). A review of bot protection using CAPTCHA for web security, *IOSR Journal of Computer Engineering*, *6*, 36-42.

Shirali-Shahreza, M. H., & Shirali-Shahreza, M. (2006). Persian/Arabic CAPTCHA. In *Proceedings of the IADIS International Conference on Applied Computing* (pp. 258-265).

Singh, P. V., & Pal, P. (2014). Survey of different types of CAPTCHA. *International Journal of Computer Science and Information Technologies, 5*(2), 2242-2245.

Tangmanee, C., & Sujarit-apirak, P. (2013). Attitudes towards CAPTCHA: A survey of Thai internet users. *The Journal of Global Business Management, 9*, 29-41.

Von Ahn, L., Blum, M., & Langford, J. (2004). Telling humans and computers apart automatically. *Communications of the ACM, 47*(2), 56-60.

W3C. (2008). *Web Content Accessibility Guidelines (WCAG) 2.0.* Retrieved December 10, 2014, from World Wide Web Consortium: http://www.w3.org/TR/WCAG20

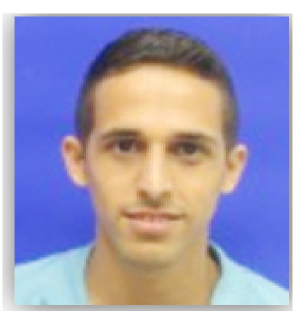
White, J., Goette, T., & D. Young, D. (2005). Measuring the accessibility of the U.S. State Government web sites. *Communications of the International Information Management Association 5*(1), 31-40.

WHO. (2015). *Fact sheet N°300: Deafness and hearing loss*. World Health Organization. Retrieved June 7, 2016, from: http://www.who.int/mediacentre/factsheets/fs300/en/

Williams, P., & Hennig, C. (2015). Effect of web page menu orientation on retrieving information by people with learning disabilities. *Journal of the Association for Information Science and Technology, 66*(4), 674-683.

Biographies

Ruti Gafni is the Head of the Information Systems B.Sc. program at The Academic College of Tel Aviv Yaffo. She holds a PhD from Bar-Ilan University, Israel (in the Business Administration School), focusing on Information Systems, an M.Sc. from Tel Aviv University and a BA (Cum Laude) in Economics and Computer Science from Bar-Ilan University. She has more than 30 years of practical experience as Project Manager and Analyst of information systems. She also teaches in the Management and Economics MBA program at the Open University of Israel.



Idan Nagar is a graduate of the Information Systems B.Sc. program at The Academic College of Tel Aviv Yaffo, and a student of the MA Interdisciplinary design innovation and entrepreneurship at The College of Management Academic Studies. He worked as an Information Systems implementer, and served as a data analyst in the Israeli Air Force. Idan is a Mobile-Web developer, especially interested in Human-Computer Interaction and particularly in UI/UX design, development and measurement

This page left blank intentionally

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Shapira, N., Kupermintz, H., & Kali, Y. (2016). Design principles for promoting intergroup empathy in online environments. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 225-246. Retrieved from http://www.informingscience.org/Publications/3605

Design Principles for Promoting Intergroup Empathy in Online Environments

Noa Shapira
University of Haifa & CET, Haifa, Israel
noas@cet.ac.il

Haggai Kupermintz
University of Haifa, Haifa, Israel
kuperh@edu.haifa.ac.il

Yael Kali
University of Haifa, LINKS-ICORE, Haifa, Israel
yael.kali@edtech.haifa.ac.il

Abstract

This study examined a professional development program designed to support Civics teachers in their efforts to promote empathy among Israeli Jewish students towards Israeli Arabs. The design rationale for the program is that teachers should experience empathic processes themselves before supporting their students in such an endeavor and that meaningful empathic processes can occur online if activities are properly designed. All phases of the program were designed to support teachers to participate as part of an online community of practice. Sixty Jewish teachers participated in two iterations of the design study. Refinements were made in the second iteration to provide teachers with explicit definitions of empathy and specific instructions for reflection. Findings indicate that these changes were reflected in higher degrees of empathic responses among teachers. Teachers also indicated that being a part of an online learning community contributed to the learning process they experienced during the program. We interpret this as a first step in enabling teachers to assist their students to develop a more empathetic approach toward the minority group and conclude with a discussion of recommended design principles for promoting such an approach.

Keywords: empathy, minority group, teacher professional development, teachers as designers, online learning community

Introduction

The current study examined a teacher professional development (TPD) program, aimed at supporting teachers who seek to address some of the educational challenges related to the complex relations between the Arab minority and Jewish majority in Israel. These relations are characterized by mistrust and separation between the groups. The division between Arabs and Jews in Israel is widespread

Editor: Janice Whatley

An earlier, shorter version of this paper was presented at the Chais conference 2016, in Raanana, Israel, and included in Y. Eshet-Alkalai, I. Blau, A. Caspi, N. Geri, Y. Kalman, & V. Silber-Varod (Eds.), *Proceedings of the 11th Chais Conference for the Study of Innovation and Learning Technologies 2016: Learning in the Technological Era*. Raanana: The Open University of Israel.

throughout society: in schools, government institutions, and places of residence (Smooha, 2010). The conflict between the groups is over issues central to both societies such as territories, self-determination, statehood, religious dogmas, and core values (Bar-Tal. 2007). As a result, deeply rooted collective narratives determine each side's point of view (Bruner, 1990, Coleman, 2003, Salomon, 2004). For example, Israeli Jews and Arabs disagree on whether the country can simultaneously be a Jewish state and democracy. About three-quarters (76%) of Israeli Jews believe this to be possible, but relatively few (27%) Israeli Arabs agree (Pew Research Center, 2016). These differences and disagreements, in the context of the wider Israeli-Palestinian conflict (Maoz, 2011; Steinberg & Bar-On, 2002), affect the relations between the groups, which are often characterized by mutual negative attitudes, de-legitimization, dehumanization, and prejudice towards the minority group (Bar-On, 2008; Bar-Tal, 2000, 2001). In a survey of more than 5,000 Israelis (Pew Research Center, 2016), nearly half (48%) of Israeli Jews supported statements saying that Arabs should be transferred or expelled from Israel; most (79%) Israeli Arabs indicated that discrimination in Israeli society against Arabs is widespread, while 74% of the Jewish majority did not acknowledge much discrimination.

The implications of the continuous conflict are reflected in everyday life in Israel in general, and in schools in particular. The culture of conflict encompasses everyday conversations, such as the news and political speeches, and teachers find it hard to effectively manage the dissonance in the socio-political environment that surrounds and affects students (Rosen & Perkins, 2013). In general, discussions about racism, diversity, privilege, and social justice are often sources of discomfort (Watt, 2007). Furthermore, peace education, conflict resolution, shared life, and coexistence programs in Israel face the challenge of collective narratives, histories, and beliefs (Kupermintz & Salomon, 2005). As a result, Civics education in Israel is a particularly difficult task, where little consensus exists on what should be the fundamental nature of society and what binds citizens together (Byrne, 1997; Ichilov, 2003).

The destructive effects of prolonged intergroup conflict underscore the urgent need for interventions that promote tolerance and cooperation (Stathi & Crisp, 2008). Teachers should be committed to fostering not only the academic development of students but also their social and emotional development (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011), especially in a divided society. To address this challenge, the educational approach we describe is based on the premise that empathy is an important social and emotional skill, necessary to improve relations between groups and to reduce prejudice and discrimination toward minority groups (Batson & Ahmad, 2009, Eisenberg, Eggum, & Di Giunta, 2010, Stephan & Finlay, 1999). In order to help teachers promote empathy and reduce negative attitudes towards the Arab minority group, the current study developed and examined an online teacher professional development (TPD) program that uses clips from a popular television series – *Arab Labor*. The series was one of the first Arabic-language television shows in Israel that combined Arab and Jewish actors, and was broadcast in prime time. The series presented the complexities of Arab minority life in Israel with humor and compassion and adopted a critical view towards both groups in Israeli society. Clips from the series were embedded in an educational website developed at the Center for Educational Technology (CET) and served as resources for the online TPD environment entitled "Fostering Empathy through E-Learning" (FEEL). The goal of the FEEL program is to support teachers in developing the skills and knowledge required to teach Civics to junior and high school students.

The FEEL program was designed as an online community endeavor, including 30 hours of interaction between teachers, spanning one school year (October-June), with three phases: teachers as learners, teachers as designers, and teachers as implementers (see detailed description in the Design section). Except for two face-to-face meetings at the beginning and the end of the school year, the entire FEEL TPD program was conducted online using the Moodle platform and facilitated by the first author of this paper. The collaborative activities were designed to support teachers in an online community of practice in sharing their ideas, practices, and experiences with their peers, and in providing ongoing feedback to each other throughout the program, using specific prompts in the online forum. The decision to design the activities in the program so that interaction between participants would take place in an online community was based on our assumption that this would enable teachers to support each other in coping with a topic that entails emotional and well as cognitive challenges (Bar-Tal & Rosen, 2009; Kupermintz & Salomon, 2005).

The main goal of the current study was to examine the principles that guided our design in terms of enhancing empathic processes among teachers. In this paper, we report and discuss findings from the first phase of the project (teachers as learners), in which teachers watched selected clips from the series, reflected on their thoughts and feelings, and shared their experiences with their fellow teachers in the online forum.

Two major questions guided our research:

(a) What empathic processes occur among teachers during the first phase of the FEEL TPD program?

(b) How does the design of the program affect teacher learning in terms of developing empathic processes?

Theoretical Background

Social and Emotional Learning in Schools

Civics is one of the core subjects in schools, along with math, science, foreign language, and reading. While schools focus mostly on academic skills, social and emotional learning (SEL) has become an increased priority for schools in the past two decades (Durlak et al., 2011; Elias et al., 1997; Goleman, 1998). These interpersonal processes are part of a broad range of 21st century skills, such as communication, collaboration, teamwork, and empathy (Pellegrino & Hilton, 2012). In the context of intergroup conflict, such skills gain further importance when teachers address explosive socio-political issues.

Unfortunately, many students seem to lack social-emotional competencies (Blum, Libbey, Bishop, & Bishop, 2004). A large survey in the United States found that only 29%–45% of the students reported that they had social competencies such as empathy, decision-making, and conflict resolution (Benson, 2006). This phenomenon is potentially exacerbated in situations of intergroup conflict. Students experience a culture of aggression through everyday interactions with their family members, mass media, and the educational system (Abu-Nimer, 2004; Rosen & Perkins, 2013). Furthermore, as reported by Elias, Bruene-Butler, Blum, & Schuyler (2000), teachers tend to resist incorporating SEL programs, which usually require much time at the expense of more valued “academic” content. They often think that fostering SEL skills is beyond their expertise and should be the domain of school psychologists, counselors, therapists, or parents. Teachers also tend to fear that these programs would have no effect due to the increasing numbers of students with aggression and other troublesome behavior patterns (Elias et al., 2000).

Empathy – A Social and Emotional Skill

The FEEL program underscores empathy as a key SEL skill. Empathy is the inclination to share emotions and to understand the thoughts of others (M.H. Davis, 1994; Decety & Meyer, 2008). In previous years, empathy was defined either as an essentially emotional phenomenon (Batson 2014; Strayer & Eisenberg 1987) or as the ability to cognitively understand the other’s point of view without necessarily experiencing an emotional process (Wispé, 1986). Contemporary conceptual frameworks underscore the multidimensional nature of empathy and include cognitive, emotional, and behavioral components (M.H. Davis, 1983; Zaki & Ochsner, 2012). The current study is based on the 3R (Resonance, Reasoning, Response) model of empathy (Zisman, 2009), as described below.

Empathic resonance: The first phase is a spontaneous, automatic, and involuntary affective resonance with the emotional state of the other person (Hodges & Wegner, 1997), sometimes referred to as parallel empathy or emotional contagion (Batson & Ahmad, 2009; M.H, Davis, 1994; Decety & Jackson, 2004; Stephan & Finlay, 1999). It involves feeling as another person feels, thus sharing their subjective states (Batson & Ahmad, 2009; Decety & Meyer, 2008; M.H. Davis, 1994). From a developmental perspective, this process provides the foundation for understanding that the others are "like me" (Meltzoff & Decety, 2003).

Empathic reasoning: Spontaneous resonance is followed by a more elaborate, contextualized, and controlled cognitive appraisal and reasoning process (Hodges & Wegner, 1997). The cognitive or perceptual component includes considering understanding the other's mental states (Zaki & Ochsner, 2012). This process entails perspective taking, by explicitly imagining the other's perspective and how one would think and feel if they were "in their shoes" (Batson & Ahmad, 2009; M.H. Davis, 1994; Stephan & Finlay, 1999).

Empathic response: Finally, resonance and reasoning lead to an internal response to the other's situation. This response may consist of compassion-related emotions, usually labeled empathic concern, feeling sympathy, compassion, or concern for the target's well-being (Batson & Ahmad, 2009; M.H. Davis, 1994). These responses are often associated with altruistic motivations and behaviors, such as pro-social concern and expressing motivation to improve the target's experiences, or behaviors like offering help or attempting to reduce suffering (M.H. Davis, 1994; Zaki & Ochsner, 2012). In other situations, the response may evoke negative feelings and personal distress in the face of the suffering of the other (M.H. Davis, 1994).

Intergroup Empathy

Empathy plays a crucial role in moral development, motivating prosocial behavior and inhibiting aggression toward others (Hoffman, 2001; P. A. Miller & Eisenberg, 1988) and is often considered at the interpersonal level. In recent years, there is a growing understanding of empathy at the intergroup level, especially when two groups are in conflict (Batson & Ahmad, 2009). Empathy-related processes might reduce antisocial behavior that could harm individuals from stigmatized groups. Bullying and similar offenses are related to low levels of empathy, but if empathy is fostered toward a member of another group or a stigmatized person, we would expect less prejudice and discrimination toward them (Eisenberg et al., 2010).

People differentiate groups to which they belong (in-groups) from groups to which they do not belong (out-groups) (Tajfel & Turner, 1979; Turner, Hogg, Oakes, Reicher, &Wetherell, 1987). Such social categorization processes influence intergroup empathy. Favoring one's own group results in more empathy for an in-group member than for an out-group member (Eisenberg et al., 2010; Tarrant, Dazeley, & Cottom, 2009). Intergroup conflict is especially associated with diminished levels of empathy (Batson & Ahmad, 2009). Strong negative emotions interfere with the ability to imagine or legitimize the other side's perspective (Kupermintz & Salomon, 2005). Groups involved in long-lasting and violent conflicts develop psychological conditions that help them cope with the continuous threat and violence that include a positive view of one's own collective, while the other is perceived as the immoral aggressor (Bar-Tal, 1995, as cited in Steinberg & Bar-On, 2002). Numerous examples demonstrate the destructive effects of low-level intergroup empathy: Apartheid in South Africa, racial discrimination in the United States, and religious and ethnic hostility in the Middle East and Northern Ireland (Batson & Ahmad, 2009).

It is therefore important to understand and learn to improve empathic processes, or at least prevent their erosion, in situations of intergroup conflict. The gradual development of empathic interpersonal relations may be key to improving intergroup relations through educational interventions (Kupermintz & Salomon, 2005), and a technology-enhanced environment can play an important part in this endeavor (García-Pérez, Santos-Delgado, & Buzón-García, 2016).

Fostering Intergroup Empathy

Studies conducted in recent years suggest several ways to improve intergroup relations by fostering empathic skills.

Contact between groups

Intergroup contact, under the appropriate conditions, may increase positive intergroup emotions and enhanced empathy, as well as reduce negative emotions such as anxiety (Pettigrew & Tropp, 2006, 2008; Tam et al., 2008). Contact improves intergroup relations by enhancing knowledge about the out-group and reducing perceived threat and apprehension regarding meeting members of the other group. The contact enables one to take the perspective of out-group members and may contribute to improved intergroup attitudes (Pettigrew & Tropp, 2008). Already in the 1950's, four conditions were specified for optimal intergroup contact: equal group status within the situation, common goals, intergroup cooperation, and support from authorities (Allport, 1954). These optimal conditions are hard to achieve in a context of conflict, separation between groups, and strong negative emotions. In such circumstances, it is possible to resort to indirect contact as the first stage before an actual meeting between the groups (Batson & Ahmad, 2009; Stathi & Crisp, 2008).

Imagining contact

Imaginary contact can elicit positive intergroup attitudes. This may have practical implications especially in the context of intergroup conflict where direct contact is difficult to attain, such as in schools in conflicting societies. Schools in such contexts can develop and apply teaching techniques that would encourage imaginary contact in order to bring groups closer together and promote tolerance (Stathi & Crisp, 2008). Books, plays, movies, television, and radio can present the out-group members in a way that draws the reader into their lives, plight, and struggles. A skilled writer can lead the audience to imagine how the out-group member is thinking and feeling (Batson & Ahmad, 2009). Using the power of new media and technology (Umaschi Bers, 2006), media programs and storytelling methods can foster empathy using both real and fictional characters (Steinberg & Bar-On, 2002; Zillman, 2006) that may generalize to the out-group as a whole (Andersen, Downey, & Tyler, 2005; Pettigrew, 1998). A year-long field experiment in Rwanda tested the impact of a radio soap opera on reducing intergroup prejudice, violence, and trauma in two fictional Rwandan communities. Listeners' emotional reactions to the soap opera were visible, audible, and frequent, and fostered more trust, empathy, and cooperation (Paluck, 2009).

Empathy in a technology-enhanced environment

Research indicates that it is possible to experience empathy online: Users can feel empathy in online communities towards other members (Preece & Ghozati, 2001; F. Miller & Wallis, 2011). In fact, "virtual empathy" is described as a key competence in "education 3.0" environments (García-Pérez et al., 2016). Bos, Olson, Gergle, Olson, & Wright (2002) found video and audio conferencing groups were nearly as good as face-to-face communication in developing trust and supportive interpersonal relationships. A study of 301 Northern California high school students examined the effects of playing a simulation game, *Real Lives*, that allows teenagers to simulate the lives of people in other countries. Students who played the simulation game expressed more global empathy and identification with culturally and geographically distal characters when compared to a control group (Bachen, Hernandez-Ramos, & Raphael, 2012). Manney (2008) provided several examples: presenting complex questions and real-life issues within an online game has a positive effect on empathy; internet sites, such as blogs written in a war zone, encourage empathy and global understanding; and virtual reality can be used to create empathetic scenarios by reproducing the differing perceptions of other people.

While imaginary contact through popular media in a technology-enhanced environment can promote empathy processes, it is not enough to passively experience the lives of the out-group. An important principle is to invite participants to identify with members of the other group as they read about them, listen to them, or watch a video that presents them. It is recommended to add questions such as; "What emotions are the members of the other group feeling, what are they thinking, how are they viewing the world, and how do you feel about their responses to the situation?" (Stephan & Finlay, 1999) Perspective-taking and role-playing (e.g., speaking from the other's point of view) can help build and sustain empathy (Rosen & Perkins, 2013, Stephan & Finlay, 1999).

In accordance with the above insights, the current study used clips from a popular television program that presented the life of a low-status minority group, following tailored instructions and specific guidance, to foster empathy processes among teachers and their students.

Teachers in a Community of Practice

The social-constructivist view of learning is that people learn best not by assimilating knowledge, but rather by a knowledge-construction process that involves doing, becoming, and belonging to a learning community (Bielaczyc, Kapur, & Collins, 2013). "Communities of practice rely on situated theories of knowledge, i.e., the idea that knowledge is a property enacted by groups of people over time in shared practices, rather than the idea that knowledge is a cognitive residue in the head of an individual learner" (Hoadley, 2012, p. 229). However, schoolteachers rarely have the opportunity to participate in discussions and to collaborate about their practice (Barab, Makinster, Moore, & Cunningham, 2001; Darling-Hammond, 1997). Both novice teachers (Herrington, Herrington, Kervin, & Ferry, 2006) and experienced teachers (Tschannen-Moran & Hoy, 2007) report experiencing isolation and a lack of support in schools. The sense of isolation, in addition to the need for shared practice and participatory processes, may be exacerbated if teachers try to find ways to foster empathy towards a minority group in a context of continuous conflict and an environment hostile to coexistence.

With this in mind, we adopted a pedagogical approach using a community of practice for supporting teacher learning in the FEEL TPD program, with the aim of decreasing the sense of isolation teachers might experience in their workplace and providing opportunities for shared practices (Bielaczyc et al., 2013, Barab et al., 2001; Hoadley, 2012). Technological supports and especially infrastructure that enables teachers to participate in online learning communities can address these challenges by fostering collaborative peer learning in various manners (Bielaczyc et al., 2013; Kali & Linn, 2007; Linn, Davis, & Bell, 2004). Technology can directly support communication, provide tools for discussion with others, and provide a shared repository of information and other resources (Hoadley, 2012). Research shows that even when minimal face-to-face components are involved, online learning can provide learners with the benefits of belonging to a learning community (e.g., Barab et al., 2001; Kidron & Kali, 2015). Online communities of teachers or communities of practice have become known for their potential to promote professional development by providing continuous support, promoting ongoing interaction, and sharing common practices (Barab & Duffy, 2000; Barab et al., 2001; Barab, MaKinster, & Scheckler, 2003; Hur & Brush, 2009).

There are many reasons for teachers to share the knowledge and emotions related to their practice with their colleagues in online communities, for instance, (a) feeling a sense of support, belonging, and combating isolation (Ellis, Oldridge, & Vasconcelos, 2004; Hur & Brush, 2009); (b) the will to improve the welfare of community members; (c) fostering affinity between colleagues; (d) and altruism in supporting other teachers (Hew & Hara, 2007). Teachers can feel empowered by being part of a collective enterprise that works together toward shared goals, impacting motivation and engagement (Bielaczyc et al., 2013). Research also shows that fostering a group norm of in-group empathy can promote more positive attitudes towards people from another group (Tarrant et al., 2009). Consequently, in the context of conflict between groups, teachers who struggle with negative attitudes and racism in their classrooms can find that online communities provide a source of mutual learning, support, and even empathy.

The design of the FEEL program is also based on similarities that we identified between methods regarding ways to promote empathy between groups, as described in the first section of the theoretical background, and ways to promote learning in a community as described above. Table 1 illustrates these similarities.

Table 1: Similarities between the ways to foster online learning communities and ways to foster empathy through inter-group contact

Ways to foster an online learning community (Bielaczyc et al., 2013)	Ways to foster empathy between groups (Batson & Ahmad, 2009; Stephan & Finlay, 1999)
Mutual respect is sought between people from diverse backgrounds, perspectives, and minority views.	Mutual respect is sought between groups.
Participants are encouraged to find a shared objective for their learning, and to be part of a collective enterprise that works together toward shared goals.	An effort is made to reach a common goal through intergroup contact.
By setting up collaborative groups and jointly produced consequential tasks, learning communities foster interdependence based on diverse expertise, which encourages participants to rely on and value the work of others and to contribute in a variety of ways to help advance the work of the collective.	Cooperative learning is used to improve intergroup relations (e.g., using Jigsaw activities).

We postulated that by implementing design principles, that foster the development of an online community of practice among teachers (Kali, 2006; 2008; Kali & Linn, 2007), the FEEL TPD program would assist teachers in a number of ways, including combating isolation, developing a sense of belonging to a broader group, benefitting from mutual learning and support from colleagues, and most importantly, promote empathy towards the Arab minority in Israel.

The Design of the FEEL TPD Program

The FEEL TPD program was designed to promote intergroup empathy by means of three main design principles derived from the theoretical background described above. We consider these principles as ‘pragmatic design principles’ in the design principles framework (Kali, 2006; Kali & Linn, 2007), which served as a conceptual basis for developing the Design Principles Database (DPD) (Kali, 2008). The DPD was developed as an infrastructure for designers to publish, connect, discuss, and review design ideas. The DPD includes 1) **Specific Principles** that connect directly to a single feature or single research investigation and that provide the specific rationale behind the design of that feature; 2) **Pragmatic Principles** that connect several Specific Principles; and 3) **Meta-Principles** that capture abstract ideas represented in a cluster of Pragmatic Principles. For example, a specific design principle can describe a specific feature in a learning environment that supports interaction between teachers. This specific principle can be connected to several pragmatic design principles, one of which is "Enable multiple ways to participate in online discussions", which is connected to the higher level meta-principle of "Help learners learn from each other" (Kali, 2006; 2008; Kali & Linn, 2007).

Based on the literature review presented above, we suggest the following pragmatic design principles for promoting intergroup empathy in online environments (Figure 1). These three principles can be viewed as employing the Meta-Principle 'help learners learn from each other'.

Design principle 1:	Use popular media as a preliminary phase in promoting empathic processes through and "Imaginary contact".
Design principle 2:	Provide explicit prompts for empathic reflection.
Design principle 3:	Foster the development of learning-community that embraces empathy as a shared value.

Figure 1: Design principles we suggest for promoting intergroup empathy in online environments

The decision to study empathic processes only within the Jewish population was based on findings that show that the Jewish population in Israel is less empathetic towards the Arab population than Arabs are towards Jews (Zisman, 2009), as well as on the growing understanding of the importance of uni-national educational programs in situations of intractable conflicts (Bar-Tal & Rosen, 2009). As mentioned above, when positive contact is difficult to obtain, encouraging imagery or indirect contact is a desirable first stage before bringing groups closer together (Stathi & Crisp, 2008).

Components of the Program

Based on the pragmatic design principles for promoting intergroup empathy in online environments (Figure 1), the FEEL TPD program includes the following components, which are embedded into each other, as illustrated in Figure 2:

1. **The online TPD FEEL environment.** This interactive environment was designed and developed in the current study to enable teachers to work as a distributed community of practice mentored by the first author, and to guide them through all phases of the program, the details of which are described below (Moodle was used as the platform).
2. **CET's educational website.** This educational website, designed by CET for open use by the public, includes dozens of television episodes as well as some guiding questions to reflect on the episodes (Figure 3). No interactivity is designed in the website. Therefore, it was used as a resource for further interactivity in the FEEL program.
3. **Clips from the television series *Arab Labor***, selected for use as:
    a. Resources (e.g., lesson plans and collaborative activities) embedded in the educational website developed at CET
    b. Reflection catalysts embedded in the FEEL environment.

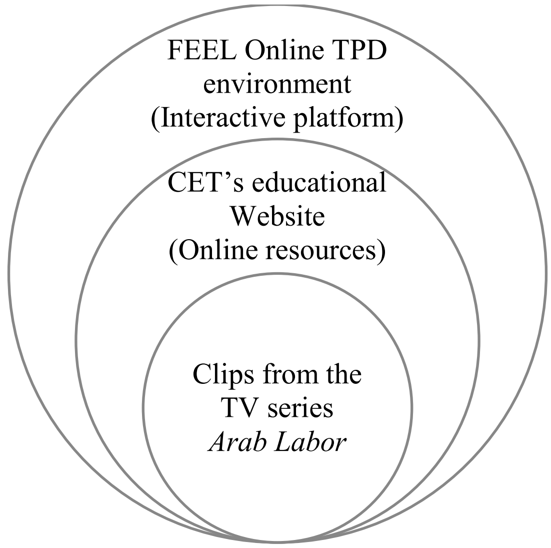


Figure 2: The Design of the FEEL TPD Program

Figure 3: Educational website (CET)

Stages of the Program

The FEEL TPD program includes three phases: Teachers as learners (designed to be enacted during the first trimester of the school year); Teachers as designers (second trimester); and Teachers as implementers (third trimester). We describe the three phases to provide a wider context for the current study, which focused on the first phase – teachers as learners.

(1) Teachers as learners:

> Teachers often provide role models for their students (Eccles & Roeser, 1999). In the context of the current study, this means that teachers need to develop their own emotional skills, such as self-awareness, and use of emotions in instructional situations (Jennings & Greenberg, 2009). Personal experience is key in this development (Zins, Bloodworth,

Weissberg, & Walberg, 2004); therefore, we sought to provide teachers with a meaningful learning experience about empathy as a social and emotional skill, in order to help them foster, as role models, the development of similar processes among their students.

During the first two months of the program, teachers were required to watch selected clips from the series' episodes in their free time and were asked to choose three clips from the educational website to reflect upon, using the prompts for reflection. The first design principle (suggesting using popular media) was implemented in both iterations of the study in this phase. However, the second design principle was added only in the second iteration, in which teachers followed explicit prompts for empathic reflection. They wrote down in the online forum all the emotional and cognitive processes they experienced. As part of employing the second design principle (suggesting providing explicit prompts for reflection), they were also asked to imagine how the characters in the clip felt and wrote about that in the online forum (see details about the differences between the iterations below). The third design principle (suggesting fostering empathy as a shared value in the community) was reflected in both iterations: The teachers shared their experiences and practices with their fellow teachers and responded to each other as part of a community of practice.

For example, one clip presented a meeting between Amjad, an Israeli-Arab (the main character), and his Jewish neighbor Yehuda who offended him. The prompt asked the teachers to reflect on their thoughts and feelings during and after watching each clip. An example from one of the teachers' reflection (showing an empathetic response) is, "Amjad's response evokes sadness about how he chooses to 'give himself up' for the sake of integration [within Jewish society]."

(2) Teachers as designers:

Based on their experiences during the previous phase of the FEEL TPD program, teachers at this phase were required to interpret the technology-enhanced resources that appear in the educational website and adapt them for the use of their students and classroom settings (E.A. Davis & Varma, 2008; Matuk, Linn, & Eylon, 2015). The teachers used Bielaczyc's (2013) Social Infrastructure Framework to guide them in their design process. This framework explicates the various elements of classroom social structures that might influence the design. We assumed that involving teachers in the design of a learning environment for their students might help them adapt the program to their specific classrooms with particular learners; to increase ownership and commitment for implementation; and motivate them to engage in this practice (Kali, McKenney & Sagy, 2015). We also assumed that the engagement of teachers in designing their own learning materials would assist them in coping with instructions of new and complex content such as empathy between groups in conflict. Throughout the design process, teachers shared their designed learning environments with their colleagues and gave each other feedback in the online forum.

(3) Teachers as implementers:

Teachers implemented the learning environment they designed in their classrooms. They shared their experiences with their fellow teachers and responded to each other in the online forum. Records of practice enabled teachers to examine one another's instructional strategies and student learning and to discuss ideas for improvement (Borko, 2004; Little, Gearhart, Curry, & Kafka, 2003).

The Role of the Facilitator

Except for two face-to-face meetings at the beginning and the end of the school year, the entire FEEL TPD program was conducted online. During the first face-to-face meeting, the facilitator demonstrated and explained the 3R model of empathy and the role of empathy in intergroup relations (in the second iteration), the FEEL TPD phases, the role of the teachers as designers of their students' learning environments, and the rationale for learning as part of an online community of practice. In the second face-to-face meeting, the facilitator invited one of the actors from the TV series to discuss the issue of shared lives in Israel and his experience as an actor on the show. Finally, the facilitator encouraged the teachers to reflect upon the process they underwent throughout the FEEL TPD program.

Throughout the school year, the facilitator intervened in the online forum in order to foster a sense of belonging among the teachers and engagement in the online community:

a. Teachers received ongoing messages about new responses in the online forum with a link to the specific thread, such as *"Look, Ronny tried to reduce prejudice in her classroom; how did her students respond?"*

b. In order to encourage mutual sharing, teachers received personal messages if someone responded to them.

c. At the end of the first and third phase, the teachers received a summary of all the responses of their fellow teachers, in order to help them get a sense of the main topics, challenges, ideas, and methods of coping with potential problems raised by their colleagues.

Method

This study employed a Design Based Research (DBR) methodology, in which elements of learning environments are systematically explored in terms of their effects on learning, thus contributing to the development of theory and design practice (Cobb, Confrey, Lehrer & Schauble, 2003; Design-Based Research Collective, 2003). DBR systematically explores iterative refinements of learning environments, enacted in naturalistic and local contexts (Kali, 2008; Sandoval 2014). Changes in desired outcomes as a result of these iterations are used as evidence for the viability of the theory underlying the design principles and serve to further fundamental knowledge about learning or teaching in general (Kali, 2008; Sandoval 2014).

In the current study, two groups of teachers participated in two consecutive iterations of the FEEL program. The analysis focused on the first phase of the TPD program, where teachers watched and then reflected upon selected clips and shared their experiences with other participants in the learning community. Teacher reflections from the first iteration, which were general and did not involve enough personal expressions, underscored the need for more direct and explicit prompts to elicit empathic processes. In response to this insight, two major changes were introduced in the second iteration: (a) more explicit prompts for reflection while watching the clips (Table 2), and (b) an explicit, formal introduction of the 3R model of empathy, and the concept of empathy as an interpersonal skill in the context of intergroup relations is Israel. The empathic model and the importance of empathy in intergroup relations was introduced in the first face-to-face meeting and the explanation of the 3R model was presented in the online forum. The facilitator summarized in the online forum and noted the empathic 3R model as it appeared in the teachers' reflections in order to help them get a sense of the empathic processes they and their colleagues experienced.

Table 2. Prompts for reflection and sharing in each of the iterations	
General prompts in iteration 1	**More explicit prompts in iteration 2**
1. What did you feel like during the activity and while watching the video clip? Share your ideas and thoughts with the community. 2. Have you changed your point of view of the Jewish-Arab relation in Israel (understanding the situation, willing to change the situation, identification with the situation) following the activity and the video clips? Share this with the community.	1. While watching the video clip, write down on a piece of paper all the emotions you experience. 2. After watching the video clip, share with the community the emotional and cognitive process you went through during and after watching the video clip. 3. Try to imagine what the characters in the clips felt like, and share your ideas with the community.

Participants. The participants in both iterations, 31 in the first iteration and 28 in the second iteration, were Jewish Civics teachers who were from a variety of schools and socio-political backgrounds: secular schools, religious schools, schools in the periphery, and central cities. They also varied in their prior experience of dealing with Jewish-Arab relations in their classrooms. Some have attempted to do so in the past, and for some this was their first experience. Teachers' motivation to join the program was also diverse. Some participants joined because they wanted to promote coexistence in Israel while others were curious to use the popular television show.

Intergroup empathy questionnaire: This questionnaire included 20 items and was developed to measure the 3R empathy process towards out-group members (Zisman, 2009), in this case, Israeli-Arabs. The 3R, or empathic dimensions, included Resonance – 5 items, Reasoning – 6 items and Response – 9 items. The questionnaire items used a 5-point Likert-type scale where responses ranged from "strongly disagree" to "strongly agree". An average score of the items comprising each dimension was calculated.

Example items included:

Resonance: *"Usually it's easy for me to guess what the other person wants to talk about."*

Reasoning: "*Usually, I can understand the other's point of view, even when I do not agree with them."*

Response: *"When I see people crying, I feel bad."*

The questionnaire was administered to teachers in the second iteration at the beginning (i.e., Pre) and the end (i.e., Post) of the program.

"Arab Labor" empathy questionnaire: This questionnaire was developed for this study and was based on both teachers' statements in the online forum that pertained to their empathy toward the various characters in the clips they watched, as well as on items from a questionnaire by M. H. Davis (2008) regarding empathy toward imaginary characters from movies or stories. Here too, respondents were required to choose the answer on a 5-point Likert-type scale ranging from "agree strongly" to "disagree strongly."

For example: *"I understand Amjad's (the main character) desire to belong to Israeli society and the difficulties he encountered."*

Teachers in both iterations responded to this questionnaire at the end of the program.

Reflection sharing: Teachers' reflections in the online forum, regarding their feelings while watching the clips, were coded in both iterations to capture the three empathic dimensions: resonance, reasoning and response. These responses were coded as 1=present or 0=absent (Table 3).

Table 3: Examples of empathic processes in teachers' reflections	
Resonance	*"**I felt** Amjad's (the main character) anguish as he tries to integrate into Jewish society."*
Reasoning	*"**I thought** how hard it is to adjust yourself to the reality of the majority group."*
Response	*"The neighbor's behavior toward Amjad (the main character) **infuriates me.**"*

Interviews: 12 participants were interviewed, each interview lasting approximately 40 minutes, 3 in the first iteration and 9 in the second. The goal of the interviews was to explore in a detailed manner which empathic processes occurred among the teachers, to what extent they acquired skills to appropriately teach the subject, how they perceived the effect of the learning environment's design features on their own learning, and how they believed that the process they went through might impact their students' learning. In order to identify major themes in the interviews, a content analysis was conducted according to the research questions.

Questions, for example, included:

How did the course change your feelings and thoughts about the TV show, if at all?

How did watching video clips from the series lead you to better understand the perspective of the characters, if at all?

Findings

The analyses revealed two major sets of findings:

(1) Changes in empathic processes between iterations (Research Question 1):

a. **Findings from "Arab labor" empathy questionnaire.** Teachers in the second iteration (M=4.28, SD=0.35) scored significantly higher than teachers in the first iteration (M=3.86, SD=0.78) on the questionnaire 'Empathy toward the characters in the television series' ($t(47)= 2.54$, $p<.01$).

b. **Findings from reflections.** In the second iteration teachers exhibited a significantly higher degree of empathic responses in their reflections compared with teachers in the first iteration ($\chi2(1) = 6.42$, $p <.01$) (Table 4).

Table 4. Empathic responses from the reflections – Iterations 1 & 2

	Iteration 1 (n=31)	Iteration 2 (n=27)		
	Frequency	**Frequency**	**df**	**X2**
Empathy - (General)	87.1%	92.6%	1	.47
Resonance	51.6%	40.7%	1	.69
Reasoning	71.0%	74.1%	1	.07
Response	45.2%	77.8%	1	6.42*

* $p < .01$

(2) Changes in empathic processes within iteration 2:

Findings from 'Intergroup empathy questionnaire'. The analysis of the second iteration revealed an overall significant gain between the beginning (M=3.8, SD=0.4) and the end (M=4.0, SD=0.4) of the program (t(27)= -2.57, p<.05). This change was reflected mostly on the resonance and response scales (Table 5).

Table 5: Pre and post 'Intergroup empathy questionnaire' scores – Iteration 2

	Pre (n=28)		Post (n=28)		
	M	**S.D.**	**M**	**S.D.**	**t (df =27)**
Empathy - (General)	3.88	.44	4.02	.36	-2.57*
Resonance	3.33	.63	3.60	.59	-2.57*
Reasoning	3.90	.53	3.93	.48	-0.37
Response	4.16	.57	4.33	.45	-2.15*

* $p < .01$

Qualitative evidence from the interviews provided further support for the findings:

The empathic processes that occur among teachers (supporting our answer for research question 1)**:**

The excerpts below represent the ability of the teachers to understand the Arab perspective (i.e., empathic reasoning), and to react in accordance to that perspective (i.e., empathic response).

"I feel empathy towards Israeli Arabs; ***I understand*** *their difficulty and the discrimination they suffer from".*

*"**It bothers** me they know our language but we don't do anything to get to know their language".*

Teachers' **use of clips from 'Arab Labor' as resources** (supporting our answer for research question 2):

The excerpts below represent that the emotional impact of the video clips on teachers was stronger than in their preliminary experience with the series before the FEEL TPD.

"Looking at things … from the point of view of pain… even if you see that the actor (Amjad, the main character) … is a little afraid… to say (his opinion) … you can understand why. You actually feel like him".

"... I have a bit of each character in me ... I see myself in all of the characters... "

"Before (the FEEL TPD) I saw mostly the laughter. Now I see the pain"

The effect of learning as an online community (supporting our answer for research question 2)**:**

Teachers greatly benefitted from the learning community, which provided them with opportunities for further development with regard to empathic processes.

"Responses were really interesting for me, so I found myself coming back [to the online forum], checking and reading every response from the beginning and trying to understand and learn from it".

"… Each one [of the teachers] has their perspective, and it has created mutual enrichment".

> *"... I tried to read responses of people who are different than me, and it was interesting ... to be exposed to more teachers ...."*

To summarize, the findings indicate a significant growth in empathic levels during the first phase of the FEEL TPD program. These findings, combined with information gleaned from the interviews pertain to the second question and suggest that the design of the program affected teachers' learning.

Discussion and Conclusions

A main rationale for designing the FEEL program was that teachers should experience empathic processes themselves, and share their experiences with their colleges, before being able to support their students in a similar endeavor. The current study examined the first phase for this pedagogical model – teachers as learners. During this phase, we examined the specific design elements that increase the likelihood of eliciting empathic processes towards an ethnic minority group. Our findings provided support for the reasoning guiding the pedagogical model, and demonstrated how use of media in a teacher learning community can enhance intergroup empathy in an online environment.

The first research question focused on the empathic processes that occurred during the first phase of the program. Findings showed that teachers did experience intergroup empathy processes during this phase, as reflected in the significant gain in empathy between the beginning and the end of the program in the second iteration. Additionally, a significant increase in teachers' empathic responses was found between the first to the second iteration. The changes were associated with teachers' guided exposure to powerful media clips and reflective sharing in an online community. These findings demonstrate the importance of teacher personal experiences in developing social and emotional skills as documented in previous studies, which concluded that teachers should develop their own such skills in order to teach them effectively (Jennings & Greenberg, 2009; Zins et al. 2004). The current study underscores the potential of an online learning environment to support such processes and the use of popular media following tailored prompts to promote empathy.

The second research question dealt with the design of the program and its effect on teachers' learning. Our findings provide empirical support for the usefulness of the design principles that may promote intergroup empathy (Figure 1). The first design principle was inspired by research that showed the potential of positive effects of using suitable media on intergroup empathy, even in the absence of direct contact with members of the outgroup (M. H. Davis, 1980; Paluck, 2009; Stathi & Crisp, 2008; Steinberg & Bar-On, 2002; Zillman, 2006). The second design principle calls for providing tailored instructions and specific guidance to elicit meaningful empathy processes. Studies indicated that media alone is not enough to foster empathy and understanding between groups (Stephan & Finlay, 1999) and concluded that direct, detailed prompts are required to help learners process information and engage more deeply in emphasizing with outgroup members. In addition to general prompts, our design was based on the 3R model of empathic resonance, reasoning and response. These empathy dimensions provided the conceptual underpinnings for focusing the guidance for teachers. Accordingly, the prompts in the second iteration addressed mostly the more conscious and controlled reasoning and response dimensions: *"Share with the community the emotional and cognitive process you went through and try to imagine what the characters in the clips felt like"*. The instructions did not address empathic resonance, which is an implicit, spontaneous process difficult to directly control. As was suggested by others (Stephan & Finlay, 1999), a future iteration will encourage teachers to take the perspective of the characters in the series more directly, thus shedding further light on the optimal guidance to support intergroup empathy.

Teachers are mostly trained to teach core academic topics. The current study demonstrates the need for further support in dealing with social and emotional issues, especially in the challenging context of intergroup conflict. Our findings emphasize that dedicating enough time and effort to help teachers discover their own positions and attitudes towards contested issues in a divided society is necessary before implementing such programs in the classroom. Furthermore, teachers often report feeling isolated and a lack of support while dealing with issues such as prejudice and racism. The interview findings of this research suggest that an online community of practice with teachers from various backgrounds allows for constructive exposure to diverse opinions, while at the same time improving social and emotional skills.

Regarding the third design principle, all phases of the program were designed to support teachers as an online community of practice. Teachers reported that they greatly benefitted from being part of a community. The benefits of such communities to support teacher learning is congruent with previous studies (e.g., Barab et al., 2001; Darling-Hammond, 1997). The current study underscores the effectiveness of the community even when teachers come from diverse backgrounds and struggle with conditions of racism and negative attitudes among their students.

From a methodological perspective, our study shows that design-based research methodology, in which theoretical considerations are combined with practical implementation of design features, is useful for understanding the complexities of real-world practice within a challenging socio-political context (Barab & Squire, 2004). We found that media can foster empathy and that meaningful empathic processes can occur online if activities are properly designed and supported. An online teacher community can be effective even for a heterogenic group of teachers who deal with intergroup conflict.

In addition to understanding how to foster intergroup empathy, we can offer some practical implications for TPD programs designed to support teachers who wish to improve intergroup relations:

- The first phase of the TPD program should encourage teachers to experience the targeted emotional and social skills.
- We recommend beginning with imaginary contact through media that presents the out-group's narrative and point of view.
- To develop a more balanced approach towards the out-group, the facilitators should add suitable instructions and questions for reflection.
- It is important to encourage active participation by sending routine reminders, personal messages, and other such aids.

A limitation of the research is that all teachers voluntarily chose to participate in the program, and it may be concluded that they were initially sympathetic toward the goal of promoting intergroup empathy. Future studies should include teachers who are more skeptical about the potential or even desirability of improving relations among rivaling groups. It is also important to investigate the program in cases where participation may become mandatory, such as when a school principal decides that teachers must undergo such a program.

We view the change in the empathic processes – the increase in teachers' empathic responses from the first to the second iteration and the significant gain in empathy between the beginning and the end of the second iteration – as an important first step that can enable teachers to adapt the FEEL program resources productively to their classrooms. We hypothesize that when implemented in the classrooms, it will assist students to develop a more empathetic approach to the minority group and hold a more balanced view of the Jewish-Arab conflict. The effectiveness of the program for students will be examined in a third iteration. We will analyze the learning environments teachers have designed in all three iterations in order to study how the adaptations of the FEEL resources were related to teachers' experiences and the usefulness for their students.

In conclusion, we have shown how the first phase of the FEEL TPD program (i.e., teachers as learners) facilitated teachers' learning in terms of developing emotional and social skills, as they pertain to empathic processes. Teachers' empathic responses significantly increased during that phase. We have further demonstrated that the pragmatic design principles (i.e., using clips from a popular television series as resources, explicit prompts for empathic reflection, and learning as part of an online community of practice) had a measurable impact on teachers' learning. These promising findings suggest the feasibility of using similar pedagogical models (i.e., teachers as learners) in TPD programs designed to help teachers deal with challenging intergroup relations in their classrooms.

Acknowledgement

This research was supported by the I-CORE Program of the Planning and Budgeting Committee and The Israel Science Foundation grant 1716/12.

We would also like to thank CET (The Centre For Educational Technology) and especially the Civics and Shared education team who developed the educational web site 'Arab Labor', supported the teachers professional program and enabled this research to be conducted.

References

Abu-Nimer, M. (2004). Education for coexistence and Arab-Jewish encounters in Israel: Potential and challenges. *Journal of Social Issues*, *60*(2), 405-422.

Allport, G.W. (1954). *The nature of prejudice*. Reading, MA: Addison-Wesley.

Andersen, S. M., Downey, G., & Tyler, T. (2005). Becoming engaged in community: Personal relationships foster social identity. In G. Downey, J. S. Eccles, & C. M. Chatman (Eds.), *Navigating the future: Social identity, coping, and life tasks* (pp. 210-251). New York, NY: Russell Sage.

Bachen, C. M., Hernandez-Ramos, P. F., & Raphael, C. (2012). Simulating REAL LIVES: Promoting global empathy and interest in learning through simulation games. *Simulation & Gaming*, *43*(4), 437-460.

Barab, S. A., & Duffy, T. (2000). From practice fields to communities of practice. *Theoretical Foundations of Learning Environments*, *1*(1), 25-55.

Barab, S. A., Makinster, J. G., Moore, J. A., & Cunningham, D. J. (2001). Designing and building an online community: The struggle to support sociability in the inquiry-learning forum. *Educational Technology Research and Development*, *49*(4), 71-96.

Barab, S. A., MaKinster, J. G., & Scheckler, R. (2003). Designing system dualities: Characterizing a web-supported professional development community. *The Information Society*, *19*(3), 237-256.

Barab, S. A., & Squire, K. D. (2004). Design-based research: Putting our stake in the ground. *The Journal of the Learning Sciences*, *13*(1), 1–14.

Bar-On, D. (2008). *The others within us: Constructing Jewish-Israeli identity*. Cambridge, England: Cambridge University Press.

Bar-Tal, D. (2000). From intractable conflict through conflict resolution to reconciliation: Psychological analysis. *Political Psychology*, *21*(2), 351-365.

Bar-Tal, D. (2001). Why does fear override hope in societies engulfed by intractable conflict, as it does in the Israeli society? *Political Psychology*, *22*(3), 601-627.

Bar-Tal, D. (2007). Sociopsychological foundations of intractable conflicts. *American Behavioral Scientist*, *50*(11), 1430-1453.

Bar-Tal, D., & Rosen, Y. (2009). Direct and indirect models of peace education. *Review of Educational Research*, *79*(2), 557-575

Batson, C. D. (2014). *The altruism question: Toward a social-psychological answer*. Psychology Press. Hillsdale, NJ: Erlbaum.

Batson, C. D., & Ahmad, N. Y. (2009). Using empathy to improve intergroup attitudes and relations. *Social Issues and Policy Review*, *3*(1), 141-177.

Benson, P. L. (2006). *All kids are our kids: What communities must do to raise caring and responsible children and adolescents.* San Francisco, CA: Jossey-Bass.

Bielaczyc, K. (2013). Informing design research: Learning from teachers' designs of social infrastructure. *Journal of the Learning Sciences*, *22*(2), 258-311.

Bielaczyc, K., Kapur, M., & Collins, A. (2013). Cultivating a community of learners in K-12 classrooms. *International Handbook of Collaborative Learning*, 233-249.

Blum, R. W., Libbey, H. P., Bishop, J. H., & Bishop, M. (2004). School connectedness–strengthening health and education outcomes for teenagers. *Journal of School Health*, *74*(7), 231-235.

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher*, *33*(8), 3-15.

Bos, N., Olson, J., Gergle, D., Olson, G., & Wright, Z. (2002, April). Effects of four computer-mediated communications channels on trust development. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 135-140). ACM.

Bruner, J. (1990). *Acts of meaning*. Cambridge, MA: Harvard University Press.

Byrne, S. (1997). *Growing up in a divided society: The influence of conflict on Belfast schoolchildren*. Madison, NJ: Fairleigh Dickinson University Press.

Cobb, P., Confrey, J., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational Researcher*, *32*(1), 9-13.

Coleman, P. T. (2003). Characteristics of protracted, intractable conflict: Toward the development of a metaframework – I. *Peace and Conflict: Journal of Peace Psychology*, *9*(1), 1-37.

Darling-Hammond, L. (1997). Quality teaching: The critical key to learning. *Principal*, *77*(1).

Davis, E. A., & Varma, K. (2008). Supporting teachers in productive adaptation. In Y. Kali, M. C. Linn, M. Koppal, & J. E. Roseman (Eds.), *Designing coherent science education: Implications for curriculum, instruction, and policy*, (pp. 94-122). New York, NY: Teachers College Press.

Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology*, *10*, 1-17.

Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology*, *44*, 113–126.

Davis, M. H. (1994). *Empathy: A social psychological approach*. Boulder, CO: Westview Press..

Decety, J., & Jackson, P. L. (2004). The functional architecture of human empathy. *Behavioral and Cognitive Neuroscience Reviews*, *3*(2), 71-100.

Decety, J., & Meyer, M. (2008). From emotion resonance to empathic understanding: A social developmental neuroscience account. *Development and Psychopathology*, *20*(04), 1053-1080.

Design-Based Research Collective. (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher*, *32*(1), 5–8.

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students’ social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development*, *82*(1), 405-432.

Eccles, J. S., & Roeser, R. (1999). School and community influences on human development. In M. H. Bornstein & M. E. Lamb (Eds.), *Developmental psychology: An advanced textbook* (4th ed.). Mahwah, NJ: Lawrence Erlbaum.

Eisenberg, N., Eggum, N. D., & Di Giunta, L. (2010). Empathy-related responding: Associations with prosocial behavior, aggression, and intergroup relations. *Social Issues and Policy Review*, *4*(1), 143-180.

Elias, M. J., Bruene-Butler, L., Blum, L., & Schuyler, T. (2000). Voices from the field: Identifying and overcoming roadblocks to carrying out programs in social and emotional learning/emotional intelligence. *Journal of Educational and Psychological Consultation*, *11*(2), 253-272.

Elias, M. J., Zins, J., Weissberg, R. P., Frey, K., Greenberg, M. T., Haynes, N., Kessler, R., Schwab-Stone, M., & Shriver, T. P. (1997). *Promoting social and emotional learning: Guidelines for educators*. Alexandria, VA: Association for Supervision and Curriculum Development.

Ellis, D., Oldridge, R., & Vasconcelos, A. (2004). Community and virtual community. *Annual Review of Information Science and Technology*, *38*(1), 145-186.

García-Pérez, R., Santos-Delgado, J.-M., & Buzón-García, O. (2016). Virtual empathy as digital competence in education 3.0. *International Journal of Educational Technology in Higher Education*, *13*(1), 1-10.

Goleman, D. (1998). *Working with emotional intelligence*. New York, NY: Bantam.

Herrington, A., Herrington, J., Kervin, L., & Ferry, B. (2006). The design of an online community of practice for beginning teachers. *Contemporary Issues in Technology and Teacher Education*, *6*(1), 120-132.

Hew, K. F., & Hara, N. (2007). Empirical study of motivators and barriers of teacher online knowledge sharing. *Educational Technology Research and Development*, *55*(6), 573–595.

Hoadley, C. (2012). What is a community of practice and how can we support it? *Theoretical Foundations of Learning*, 287–300.

Hodges, S. D., & Wegner, D. M. (1997). Automatic and controlled empathy. In W. Ickes (Ed.), *Empathic accuracy* (pp. 311-339). Guilford Press :New York.

Hoffman, M. L. (2001). A comprehensive theory of prosocial moral development. In D. Stipek & A. Bohart (Eds.), *Constructive and destructive behavior* (pp. 61–86). Washington, DC: American Psychological Association.

Hur, J. W., & Brush, T. A. (2009). Teacher participation in online communities: Why do teachers want to participate in self-generated online communities of K–12 teachers? *Journal of Research on Technology in Education*, *41*(3), 279-303.

Ichilov, O. (2003). Teaching civics in a divided society: The case of Israel. *International Studies in Sociology of Education*, *13*(3), 219-242

Iram, Y. (2006). Culture of peace: Definition, scope, and application. In Y. Iram (Ed.), *Educating towards a culture of peace* (pp. 3-12). Greenwich, CT: Information Age Publishing.

Jennings, P. A., & Greenberg, M. T. (2009). The prosocial classroom: Teacher social and emotional competence in relation to student and classroom outcomes. *Review of Educational Research*, *79*(1), 491–525.

Kali, Y. (2006). Collaborative knowledge building using the Design Principles Database. *International Journal of Computer-Supported Collaborative Learning*, *1*(2), 187–201.

Kali, Y. (2008). The Design Principles Database as means for promoting design-based research. In A. E. Kelly, R. A. Lesh, & J. Y. Baek (Eds.), *Handbook of design research methods in education* (pp. 423–438). New York, NY: Routledge.

Kali, Y., & Linn, M. C. (2007). Technology-enhanced support strategies for inquiry learning. In J. M. Spector, M. D. Merrill, J. J. G. V. Merrienboer, & M. P. Driscoll (Eds.), *Handbook of research on educational communications and technology* (3rd ed.) (pp. 445–490). Mahwah, NJ: Erlbaum.

Kali, Y., McKenney, S., & Sagy, O. (2015). Teachers as designers of technology enhanced learning. *Instructional Science*, *43*(2), 173-179.

Kidron, A., & Kali, Y. (2015). Boundary breaking for interdisciplinary learning. *Research in Learning Technology*, *23*. 1-17.

Kupermintz, H., & Salomon, G. (2005). Lessons to be learned from research on peace education in the context of intractable conflict. *Theory into Practice*, *44*(4), 293-302.

Linn, M. C., Davis, E. A., & Bell, P. (Eds.) (2004). *Internet environments for science education*. Mahawa, NJ: Routledge.

Little, J. W., Gearhart, M., Curry, M., & Kafka, J. (2003). Looking at student work for teacher learning, teacher community, and school reform. *Phi Delta Kappan*, *85*(3), 185-192.

Manney, P. J. (2008). Empathy in the time of technology: How storytelling is the key to empathy. *Journal of Evolution and Technology*, *19*(1), 51–61.

Maoz, I. (2011). Does contact work in protracted asymmetrical conflict? Appraising 20 years of reconciliation-aimed encounters between Israeli Jews and Palestinians. *Journal of Peace Research*, *48*(1), 115-125.

Matuk, C. F., Linn, M. C., & Eylon, B. S. (2015). Technology to support teachers using evidence from student work to customize technology-enhanced inquiry units. *Instructional Science*, *43*(2), 229-257.

Meltzoff, A. N., & Decety, J. (2003). What imitation tells us about social cognition: A rapprochement between developmental psychology and cognitive neuroscience. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *358*(1431), 491-500.

Miller, F., & Wallis, J. (2011). Social interaction and the role of empathy in information and knowledge management: A literature review. *Journal of Education for Library and Information Science*, 122-132.

Miller, P. A., & Eisenberg, N. (1988). The relation of empathy to aggressive and externalizing/antisocial behavior. *Psychological Bulletin*, *103*(3), 324.

Paluck, E. L. (2009). Reducing intergroup prejudice and conflict using the media: A field experiment in Rwanda. *Journal of Personality and Social Psychology*, *96*(3), 574.

Pellegrino, J. W., & Hilton, M. L. (Eds.). (2012). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. National Academies Press.

Pettigrew, T. F. (1998). Intergroup contact theory. *Annual Review of Psychology*, *49*(1), 65-85.

Pettigrew, T. F., & Tropp, L. R. (2006). A meta-analytic test of intergroup contact theory. *Journal of Personality and Social Psychology*, *90*(5), 751–83.

Pettigrew, T. F., & Tropp, L. R. (2008). How does intergroup contact reduce prejudice? Meta-analytic tests of three mediators. *European Journal of Social Psychology*, *38*(6), 922-934.

Pew Research Center. (2016). *Israel's religiously divided society*. Retrieved from: http://www.pewforum.org/2016/03/08/israels-religiously-divided-society/

Preece, J., & Ghozati, K. (2001). Experiencing empathy online. *The Internet and Health Communication: Experiences and Expectations*, 147-166.

Rosen, Y., & Perkins, D. (2013). Shallow roots require constant watering: The challenge of sustained impact in educational programs. *International Journal of Higher Education*, *2*(4), 91-100.

Salomon, G. (2004). A narrative-based view of coexistence education. *Journal of Social Issues*, *60*(2), 273-287.

Sandoval, W. (2014). Conjecture mapping: An approach to systematic educational design research. *Journal of the Learning Sciences*, *23*(1), 18-36.

Stephan, W. G., & Finlay, K. (1999). The role of empathy in improving intergroup relations. *Journal of Social Issues*, *55*(4), 729-743.

Smooha, S. (2010). Arab-Jewish relations in Israel: Alienation and rapprochement, *Peaceworks No. 67*. Retrieved from: http://dspace.cigilibrary.org/jspui/handle/123456789/31324

Stathi, S., & Crisp, R. J. (2008). Imagining intergroup contact promotes projection to outgroups. *Journal of Experimental Social Psychology*, *44*(4), 943-957.

Stephan, W. G., & Finlay, K. (1999). The role of empathy in improving intergroup relations. *Journal of Social Issues*, *55*(4), 729-743.

Steinberg, S., & Bar-On, D. (2002). An analysis of the group process in encounters between Jews and Palestinians using a typology for discourse classification. *International Journal of Intercultural Relations*, *26*(2), 199–214.

Strayer, J., & Eisenberg, N. (1987). Empathy viewed in context. In N. Eisenberg & J. Strayer (Eds.), *Empathy and its development* (pp. 389– 398). New York: Cambridge University Press.

Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. *The Social Psychology of Intergroup Relations*, *33*(47), 33-47.

Tam, T., Hewstone, M., Kenworthy, J. B., Cairns, E., Marinetti, C., Geddes, L., & Parkinson, B. (2008). Post conflict reconciliation: Intergroup forgiveness and implicit biases in Northern Ireland. *Journal of Social Issues*, *64*(2), 303–320.

Tarrant, M., Dazeley, S., & Cottom, T. (2009). Social categorization and empathy for out-group members. *British Journal of Social Psychology*, *48*, 427-446.

Tschannen-Moran, M., & Hoy, A. W. (2007). The differential antecedents of self-efficacy beliefs of novice and experienced teachers. *Teaching and Teacher Education*, *23*(6), 944–956.

Turner, J. C., Hogg, M. A., Oakes, P. J., Reicher, S. D., & Wetherell, M. S. (1987). *Rediscovering the social group: A self-categorization theory*. Oxford, UK: Blackwell Publishing.

Umaschi Bers, M. (2006). The role of new technologies to foster positive youth development. *Applied Developmental Science*, *10*(4), 200-219.

Watt, S. K. (2007). Difficult dialogues, privilege and social justice: Uses of the privileged identity exploration (PIE) model in student affairs practice. *College Student Affairs Journal*, *26*(2), 114.

Wispé, L. (1986). The distinction between sympathy and empathy: To call forth a concept, a word is needed. *Journal of Personality and Social Psychology*, *50*(2), 314.

Zaki, J., & Ochsner, K. (2012). The neuroscience of empathy: Progress, pitfalls and promise. *Nature Neuroscience*, *15*(5), 675–80.

Zillman, D. (2006). Dramaturgy for emotions from fictional narration. In J. Bryant & P. Vorderer (Eds.), *Psychology of entertainment* (pp. 215– 238). Mahwah, NJ: Erlbaum.

Zins, J. E., Bloodworth, M. R., Weissberg, R. P., & Walberg, H. J. (2004). The scientific base linking social and emotional learning to school success. In J. E. Zins (Ed.), *Building Academic Success on Social and Emotional Learning: What Does the Research Say* (pp. 3-22). Teachers College Press.

Zisman, Y. (2009). *The individual and the collective: Attachment and empathy processes in intergroup relations* (Unpublished Master's thesis). University of Haifa, Israel.

Biographies

Noa Shapira completed her B.A. in social science and her M.A. in Democracy Studies in the Open University in Israel. Her thesis was entitled: *Multiculturalism, Democracy and Violence at Israeli Schools*. She is currently a Ph.D student in the Faculty of Education at the University of Haifa and a member of the Learning in a NetworKed Society (LINKS) Israeli Center of Research Excellence (I-CORE).
Noa is a project manager at the Department for Civic Education and Shared Lives in the Centre for Educational Technology. She is responsible for developing online resources and online professional development programs for teachers, which deal with topics such as racism, human rights, and coexistence in Israel. She is also the facilitator for these professional development programs.

Haggai Kupermintz is a senior lecturer at the Faculty of Education, University of Haifa. His academic research themes include intergroup empathy (exploring the dynamics of Jewish-Arab relations in Israel) and learning-teaching processes (with a recent focus collaborative problem solving. In addition, Kupermintz specializes in research methodology, educational assessment and program evaluation, and is involved in local and national efforts in the areas of school improvement, teacher education, alternative education, and 21st century skills.

Yael Kali is an associate professor of technology-enhanced learning at the Technologies in Education Graduate Program, Faculty of Education, University of Haifa, and the director of the Learning In a NetworKed Society (LINKS) Israeli Center of Research Excellence (I-CORE). Using a design-based research approach, Kali explores technology-enhanced learning and teaching at various levels, from junior high school to higher education. Together with her students of the TEL Design group she studies the role of design, and design principles for supporting Computer Supported Collaborative Learning (CSCL), and for teacher professional development, in a Teachers as Designers (TaD) approach. Kali currently serves as an Associate Editor for the journal Instructional Science.

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Holstein, S. & Cohen, A. (2016). The characteristics of successful MOOCs in the fields of software, science, and management, according to students' perception. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 247-266. Retrieved from http://www.informingscience.org/Publications/3614

The Characteristics of Successful MOOCs in the Fields of Software, Science, and Management, According to Students' Perception

Simona Holstein and Anat Cohen
Tel Aviv University, Tel Aviv, Israel

simona.holstein@gmail.com; anatco@post.tau.ac.il

Abstract

The characteristics of successful MOOCs were explored in this study. Thousands of student reviews regarding five xMOOCs (Massive Open Online Course) in the fields of software, science, and management were extracted from the Coursetalk website and analyzed by quantitative and qualitative methods using the Garrison, Anderson, and Archer (2000) Community of Inquiry (CoI) model. The 14 characteristics found to contribute to the success of MOOCs (e.g., teacher, atmosphere, exercise) were partitioned into the teaching, social, and cognitive presence elements. In addition, cluster analysis revealed five types of learners, based on the characteristics they mentioned for course success: atmosphere, exercise, teacher, exam, and unspecified. This divides learners into groups that may prefer social, cognitive, or teaching presence. The findings of this study negate the perception that xMOOCs mostly contain teaching presence elements. This research contributes to the understanding of characteristics that contribute to successful MOOCs and sheds light on the students, too. Listening to the voices of the students and the types of characteristics that they chose to mention, enables further exploration of their preferences and expectations regarding MOOCs and, accordingly, to future adaptation between students' preferences and MOOC characteristics.

Keywords: MOOC, online learning, lifelong learning, Community of Inquiry

Introduction

Massive Open Online Courses (MOOCs) are a recent popular trend in the online learning landscape (Dabbagh et al., 2016). In the light of the high number of MOOC participants and the benefits of these courses to teaching and learning processes (Freitas, Morgan, & Gibson, 2015), in the past few years the academic community has been investigating how to maximize the potential of MOOCs. It was argued by Conole (2013) that the common partition of MOOCs into xMOOC and cMOOC is too simplistic to describe MOOCs, and better indicators still need to be developed in order to improve our understanding of the way in which students communicate with MOOCs and experience them.

Garrison, Anderson, and Archer (2000) suggested

Editor: Janice Whatley

An earlier, shorter version of this paper was presented at the Chais conference 2016, in Raanana, Israel, and included in Y. Eshet-Alkalai, I. Blau, A. Caspi, N. Geri, Y. Kalman, & V. Silber-Varod (Eds.), *Proceedings of the 11th Chais Conference for the Study of Innovation and Learning Technologies 2016: Learning in the Technological Era*. Raanana: The Open University of Israel.

the CoI model (Community of Inquiry) for online learning. This model represents a process of creating a deep and meaningful (collaborative-constructivist) learning experience through the development of three interdependent elements – social, cognitive, and teaching presence. Garrison, Anderson, and Archer (2010) expected that the CoI model would be a predictor of learning processes and learning outcomes, both from the perspective of individual courses/programs of study and lifelong learning attitudes and participation.

In the research presented in this paper, the CoI model was harnessed with two main aims: first, to explore the characteristics that contributed to the success of MOOCs from the students' perception and, second, to learn about the students themselves and their preferences. For these purposes, more than 3,400 online student reviews regarding five courses in the fields of software, sciences, and management were analyzed. These courses were selected because they received an average score of 5/5 in the CourseTalk website (https://www.coursetalk.com).

The students' reviews were analyzed using quantitative and qualitative methods, in order to identify the characteristics that contributed to the success of MOOCs from the students' perspective. First, the students' review data was analyzed using a quantitative method. MOOC characteristics were identified and classified into one of the three presence elements according to the CoI model: social, cognitive, or teaching. Subsequently, the characteristics were ranked according to their relative importance. In addition, groups of students were identified based on similar characteristics that they mentioned in their reviews. The characteristics mentioned by the students may teach us about their preferences regarding components that are required for successful MOOCs and about their preferred learning styles. Finally, students' reviews were analyzed using a qualitative method to thoroughly understand the different groups of students that were identified in the previous quantitative stage. The previous related research presents the results of the quantitative analysis of the success characteristics, focusing on course level and the differences among them. This research paper focuses more on the qualitative analysis of the success characteristics from the students' point of view, in accordance with the defined groups of learners.

The findings of this research contribute to the knowledge in the field of MOOCs. Identification, sorting, and mapping of characteristics according to the CoI theoretical model may assist in improving MOOCs development and teaching and, consequently, will contribute to research and implementation of better MOOCs. In addition, the identification of students' characteristics will allow for better matching of MOOC characteristics to students' learning styles in the fields of software, sciences, and management.

Background

MOOCs and Their Quality

A MOOC is an online course conducted over the web and designed with an open concept for an unlimited number of students. In addition to the course materials (filmed lectures, reading material, and quizzes and assessments), MOOCs provide interactive forums to support community interaction between students, professors, and teaching assistants (Greene, Oswald, & Pomerantz, 2015; McAuley, Srewart, Siemens, & Cormeir, 2010). Two types of MOOCs have been identified: cMOOCs are based on the connectivist theory, and xMOOCs are based mainly on behaviorist theory (Siemens, 2012). xMOOCs are instructor-driven online learning environments offered by most MOOCs today. Grünewald, Meinel, Totschnig, and Willems (2013) proposed an evolution of the xMOOC that bridges the gap to the cMOOC model by developing tools that allow users to create diverging paths through the learning material, involve the user personally in the problem domain with (group) hands-on exercises, and reward user contributions by means of gamification.

According to *The New York Times* (Pappano, 2012), the year 2012 was the year of the MOOC. In 2012, edX, a Harvard and MIT startup without profit intentions, reached 370,000 students. Coursera was founded the same year and reached 1.7 Million students (and is growing faster than Facebook); Udacity, a startup by Professor Sebastian Thurn from Stanford, reached 150,000 students.

MOOCs appeal to very diverse populations: the ages of students range between 11 and 85 (Konrad, 2015; Weinzimmer, 2012). More than 40% of the students are under 30 years old, and less than 10% are above the age of 60 (Christensen et al., 2013). Significantly more men are registered (approximately 60%); in addition, 34.3% of the learners are from the U.S., 31% are from OECD countries not including the U.S., 14.8% are from BRICS (Brazil, Russia, India, China, and South Africa), and 19.9% are from other developing countries (Dillahunt, Wang, & Teasley, 2014).

In the light of the rapid growth of MOOCs and their integration in education, especially in higher education, the issue of MOOCs quality is a major concern (Yuan & Powell, 2013). Since MOOCs are online courses, their quality assessment can be based on online learning quality assessment methods. Shelton (2011) analyzed 13 research works on online learning quality as perceived by different institutes. He found that the most important factor (in 10 out of 13 research papers) is the institutional commitment, support, and leadership. The second factor was found to be the teaching and learning effectiveness, which focuses on the quality of teaching and learning.

The analysis of teaching and learning quality from the students' perspective is debated among scholars. Daniel (2012) is concerned that MOOCs' assessments will be consolidated into league tables that rank the courses, while Raban (2007) says that the competition between quality and improvement is not a zero sum game and suggests that modernizing quality assurance procedures is a solution. This will allow higher education institutions to take the risk of innovating. This statement is important, especially in the context of increased use of technology in learning in general, and specifically with MOOCs. MOOCs bolster innovation and the potential for an exciting learning experience that promotes social learning, but still have the risk of reducing quality levels. According to Conole (2013), there is still a need to develop good quality measures to better understand the way students communicate with a MOOC and experience it. That is one of the drivers for this research, combining distant learning theory and students' reviews, as found in the Coursetalk website.

CoI Model

The CoI framework theory of Garrison et al. (2000) is a model that represents the process of creating a deep and meaningful (collaborative-constructivist) online learning experience through the development of three interdependent elements: social, cognitive, and teaching presence, as displayed in Figure 1.

Social presence is "the ability of participants to identify with the community (e.g., course of study), communicate purposefully in a trusting environment, and develop inter-personal relationships by way of projecting their individual personalities" (Garrison, 2009).

Teaching presence is the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes (Garrison et al., 2000).

Cognitive presence is the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse (Garrison et al., 2000).

Figure 1. CoI model (Garrison et al., 2000)

A number of research works have provided validation to the CoI model (Arbaugh et al., 2008; Garrison & Arbaugh, 2007; Kozan, 2016; Mills et al., 2016). While there is still work left in validating the combination of presence elements within diverse populations (such as universities, professional development, and high schools) and disciplines, the framework has proved to be reasonably robust. Garrison et al. (2010) expect that the CoI model will be a predictor of learning processes and learning outcomes, both from the perspective of individual courses/programs of study and lifelong learning attitudes and participation. Shea and Bidjerano (2010) suggest adding an additional dimension to the CoI model: learning presence. They suggest that learning presence should include elements such as self-efficacy and cognitive, behavioral, and motivational abilities that allow online students to manage themselves.

Students' Learning Styles

The concept that students learn in different ways has been researched for decades. Among others, Claxton and Murrell (1987) identified different learning styles and found that adapting instructional methods to students' learning style can lead to improved learning. Gregorc and Ward (1977) noted that in order to address the needs of the individual learner successfully, educators must relate teaching style to individual learning preference. D. Kolb (1985) defined Learning Style Inventory (LSI), which identifies knowledge results from the combination of grasping and transforming experiences. The LSI model defines two modes of grasping experience – concrete experience (CE) and abstract conceptualization (AC) – and two modes of transforming experience – reflective observation (RO) and active experimentation (AE). Another typology of the physiological dimensions of learning styles is Visual, Aural, Read\Write, and Kinesthetic (VARK) (Drago & Wagner, 2004). Finally, Duff (2004) differentiates between students with deep approach and surface approach, among many more learning style models.

Felder and Silverman (1988) recognized that, although the diverse styles with which students learn are numerous, the inclusion of a relatively small number of techniques in an instructor's repertoire should be sufficient to meet the needs of most or all of the students in any class, while Coffield, Moseley, Hall, and Ecclestone (2004) made a recurrent criticism of the 13 learning style models and found that too much is being expected of relatively simple self-report tests. D. Kolb's list as modified by A. Y. Kolb (2005), for example, now consists of no more than 12 sets of four words to choose from, and Richardson (2000) has pointed to a number of problems with this approach. Thus, Coffield et al. (2004) advise against pedagogical intervention based solely on any of the learning style instruments. Entwistle and Peterson (2004) developed a methodology where in-depth qualitative studies are used in conjunction with an inventory to capture a more rounded picture of students' approaches to learning. In addition, Neuhauser (2010) found no significant differences in learning style and effectiveness between online and face-to-face instruction, while Shea and Bidjerano (2010) found a positive connection between learners' self-efficacy and self-regulation measures and their ratings of their learning quality in virtual environments.

The literature emphasizes that MOOCs are based on active learner engagement in accordance with learning aims and objectives, as well as learners' earlier knowledge and skills (McAuley et al., 2010). However, xMOOCs and cMOOCS represent two distinct types of courses, pedagogically (Siemens, 2013). While xMOOCs emphasis is on scalability and addressing large classes, cMOOCs emphasis are on community and connections and are designed based on connectivism (Ravenscroft, 2011). There are researchers who argue that the xMOOCs might be better suited for studying a wide range of knowledge that can be learned through repetitive practice, while the cMOOCs enable learners to obtain "higher order creative skills" (Grünewald et al., 2013). Thus, these two pedagogical types should not be treated or evaluated in the same way (Daniel, 2012).

The Research

Research Goals and Questions

There are two main goals to the current research: the first is to identify the characteristics that contributed to the success of MOOCs and to classify them into one of the three CoI model presence elements: social, cognitive, or teaching. The second goal is to determine the learning preferences of the participants in MOOCs based on the characteristics that are mentioned in their reviews and to identify groups of learners with similar preferences.

Accordingly, the research questions are:

1. What are the characteristics that contribute to the success of MOOCs in the fields of software, sciences, and management, according to the students' perception?

2. What types of learners predominate, based on their descriptions of characteristics, for course success in the collected reviews?

Population and Research Field

Coursetalk (https://www.coursetalk.com) is the international source of students' reviews for online courses and MOOCs. The website is managed by AcademicsDirect and contains more than 40,000 courses and over 100,000 reviews. In order to explore the characteristics that contributed to successful MOOCs from students' perception, more than 3,400 reviews were retrieved from the Coursetalk.com website in 2016, regarding five courses in the fields of software, science, and management. All five courses received a 5/5 scale grade.

Partial demographic information was collected regarding the population of the five MOOCs that were selected. Since the exact information about the MOOCs' populations could not be found on the Coursetalk site, the information was collected from diverse sources. It was discovered that the general demographic information about MOOCs participants that is described in the background section above matches the information that was collected about the analyzed courses. Table 1 describes the MOOCs that were analyzed in this research, their populations, and the quantity of received reviews for each course. All analyzed MOOCs were considered to be xMOOCs.

Table 1. The analyzed MOOCs and their populations

MOOC name	Population	Reference	Initiative	Number of reviews
Introduction to Interactive Programming in Python	54,000 students from a large number of countries (e.g. Asia, Europe, and America) were registered for the first session of the course in October 2012. The student ages were between 11 and 72. A similar population was found in the 2015 course session.	Weinzimmer (2012)	Coursera	2,580
Epidemics - the Dynamics of Infectious Diseases	28,000 students participated in the first session of the course. 20% of them completed the course. The participants came from 158 countries. 25% of the students reported that they were employed.	Cohn(2014)	Coursera	330
The Science of the Solar System	2,000 students participated in the course.	Smith (2015)	Coursera	254
Introduction to Environmental Science	NA	NA	edX	230
An Introduction to Operations Management	87,000 students registered for the first session of the course. 7,000 of them completed the course. Students from all the continents except Antarctica participated in this course.	Barber (2013)	Coursera	109

Procedure

The research was conducted in two stages in accordance with the research questions, as described in Figure 2.

- The first stage focused on collecting the reviews and mapping the characteristics that contributed to the MOOCs' success. This stage was divided into four steps:
  (a) the reviews regarding the five courses were collected from the Coursetalk site using a dedicated Python programming language tool for this purpose. The tool enabled the automatic reading of thousands of students' reviews, spread over hundreds of web pages. The reviews were sorted, categorized, and saved using Microsoft Excel tables. The tables included the course name, the review content, the grade given by the reviewer, and information about course completion;
  (b) the words that appeared in high frequency were identified using R software and, while analyzing the text, conjunctions were removed and stemming was performed (removal of headers and endings from similar words such as read, reading, readings, etc.) (Lovins,

1968);
(c) a list of characteristics was built by combining similar words into attributes. In addition to the collection of data from the website, the researcher participated in the lectures, exercises, and forums of the five courses that were analyzed. This helped to improve the precision of the process of grouping words into characteristics;
(d) the characteristics were classified into one of the three presence elements: teaching, social, or cognitive, according to the CoI model.

- The second stage focused on clustering the students into groups with similar preferences, deduced from the characteristics mentioned in their reviews. This stage was completed using Cluster analysis (Kaufman & Rousseeuw, 2009). Subsequently, a qualitative analysis was performed in order to learn more about students' group preferences.

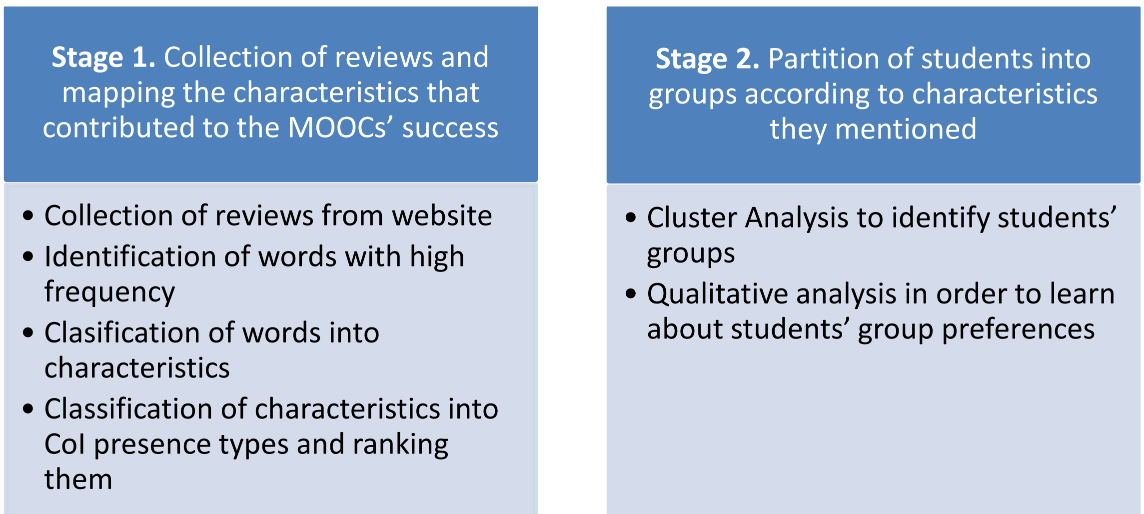


Figure 2. Research procedure

Research Method

The current research combined quantitative and qualitative analysis of the reviews (Johnson & Onwuegbuzie, 2004). It should be emphasized that it was assumed that the characteristics mentioned by the students were positive. The analysis of the reviews showed that only 1% of the students gave a grade lower than 4. In addition, 10% of the reviews with a grade higher than 4 were checked manually, and less than 0.1% of the characteristics mentioned were found to be negative.

Research Limitations

The main limitation of the research was the small number of courses that it was based on, although the courses included hundreds or thousands of reviews and a high score of 5/5. Thus, future research should be expanded to include additional courses. In addition, the reviews were collected from different sessions of the same course that were conducted during the last three years. Over this period, changes were probably made to the courses. The research is based on reviews from students that decided to post on the Coursetalk website and does not include all the students that participated in the selected courses. Not less important is the fact that the reviews on the Coursetalk website were mostly positive and related to learning from successful courses. Additional information from negative reviews in a similar quantity may add information to the list of characteristics that contributed to successful MOOCs.

Results and Discussion

The Characteristics of Successful MOOCs in the Software, Sciences, and Management Domains

The semantic analysis of the students' reviews created a list of relevant high frequency words. The words were manually grouped into characteristics. For instance, the words professor, teacher, and lecture were grouped into the characteristic called teacher. In total, 55 high frequency words were found and grouped into 14 characteristics. The following section presents the characteristics and their related words:

1. **Teacher** - Professor, lecture, teach, instruct, video, Joe, Scott, Christian, Terwiesch, Friedland, Andrew
2. **Exercise** - Project, game, build, exercise, practice, assignment
3. **Atmosphere** - Fun, entertain, humor, enjoy, passion, interesting
4. **Work load** - Work, hour, pace, week, time
5. **Peer assessment** - Peer, assess, review
6. **Complexity** - Complex, challenge, hard
7. **Forum** - Forum, discuss, community
8. **Exam** - Quiz, exam
9. **Support** - Assist, clinic, support, code-clinic
10. **Course content and organization** - Plan, organize, content, material
11. **Tools** - Codesku, tool
12. **Platform** - Coursera
13. **Material** - Paper, read
14. **Illustration** - Animation, trip

The quality of the manual grouping of words into characteristics was checked with the Chi square test, which analyzed the interdependency between the characteristics. The results yielded significant differences among the characteristics ($p<0.001$). After the quality of the characteristics' grouping was verified, the defined characteristics were sorted to find the most significant contributors to course success, and they were then classified according to the CoI model. The analysis of the MOOCs' reviews revealed the four leading characteristics to be teacher, exercise, atmosphere, and work load (in this order). Table 2 displays the rank of the characteristics, classified into the different presence elements. The empirical findings strengthen the CoI model by Garrison et al. (2000), since it was found that the top three characteristics are divided between teaching, social, and cognitive presence elements.

Although Siemens (2012) claims that xMOOC emphasizes a traditional learning method using video presentations and short quizzes, it can be seen that all three presence elements appear in the analyzed xMOOCs. Furthermore, as expected, the results show the significant influence of each presence element on course quality. It can be seen that the social presence element is significant, yet smaller than the other elements (23% for social presence, versus 36% for the cognitive and teaching elements). It is logical that in online learning, where there are no face-to-face meetings, the social presence element will be lower rated than other presence elements. The results show that the social presence element is not zero, as assumed by MOOC critics. In addition, there is a slight influence from the technological presence, as described by Anderson and Dron (2010). These findings support the claim that constructing a successful MOOC can be accomplished by including all of the presence elements.

Table 2. The characteristics that contributed to the success of MOOCs, sorted by their rank and grouped into presence elements

Presence element	Characteristic	Percentage (rank)
Teaching	Teacher	56
Social	Atmosphere	40
Cognitive	Exercise (project)	38
Cognitive	Work load	35
Teaching	Planning and course materi-al	20
Cognitive	Complexity level	14
Teaching	Exams	12
Social	Forum	11
Technology	Tools	6
Technology	Platform	6
Social	Support	5
Cognitive	External reading material	4
Social	Peer review	4
Teaching	Illustration	3

Looking at the accumulative percentage of the characteristics classified into presence elements (Figure 3), the findings indicate that all three presence elements are of significant value: the teaching and cognitive presence elements reached 36% each, while social presence was 23%, and technological presence was 5%. This emphasizes the point that the findings of the current study strengthen the CoI model.

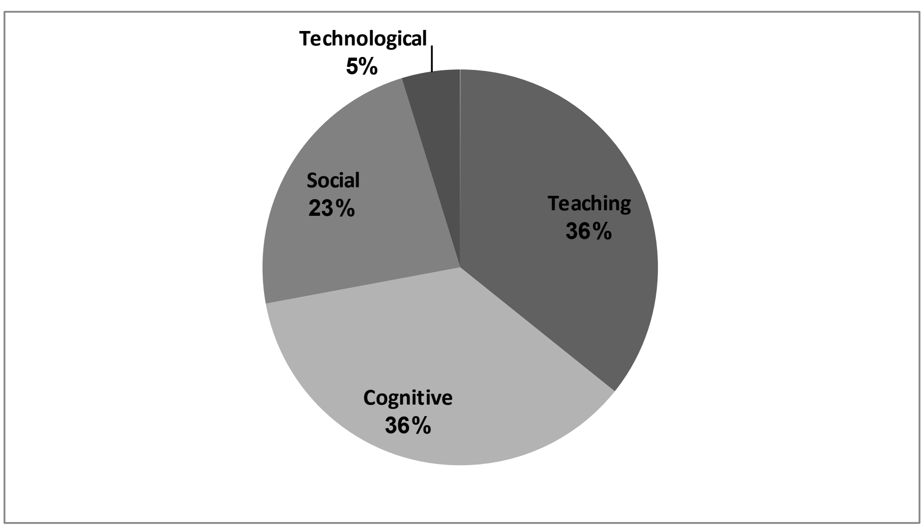


Figure 3. Accumulative percentage of the characteristics classified into presence elements

Types of Students with Similar Learning Preferences as Reflected in Their Reviews

This section presents groups of students with similarly mentioned characteristics that they perceived to be in a successful MOOC. These groups were created using k-means cluster analysis. First, four groups of students were tested through the analysis in order to fit the presences of the CoI model (social presence, cognitive presence, teaching presence, and no presence preference). This revealed a weak model (27.5%). Five groups were then tested, which revealed a fair model (35.8%). As presented in Table 3, the first group of students (N=633) mentioned mainly the atmosphere, which is related to social presence as a success factor. The second group (N=1,054) did not mention any specific characteristic. The third group (N=595) mostly mentioned exercise, which is related to the cognitive presence. The fourth group (N=838) mentioned teacher, which is related to the teaching presence; and the fifth group mentioned teacher and exam (N=340), which were both related to the teaching presence.

Table 3. Cluster Analysis - Grouping the students by success characteristics that they mentioned (without variables that have values lower than 0.1)

Group / Characteristics	Social N=633	No data N=1,054	Cognitive N=595	Teacher-Teaching N=838	Exam - Teaching N=340
Teach	0.86	0.00	0.45	1.00	0.86
Exercise	0.77	0.00	1.00	0.00	0.71
Atmosphere	1.00	0.20	0.15	0.34	0.53
Work	0.69	0.15	0.37	0.21	0.69
Assessment	0.02	0.02	0.03	0.02	0.04
Complex	0.23	0.06	0.16	0.12	0.28
Forum	0.20	0.03	0.10	0.11	0.23
Exam	0.00	0.03	0.03	0.03	1.00
Course content and organization	0.22	0.15	0.21	0.24	0.21
Tools	0.05	0.01	0.04	0.02	0.10
Platfrom	0.09	0.02	0.04	0.08	0.11

Figure 4 graphically presents the data described in Table 3 by using Linear Discriminant Analysis (LDA) (Klecka, 1980). This method illustrates the separation between the resulting clusters on a centroid plot, opposing the 1st and 2nd discriminant functions. Projection of the data onto the first discriminant axis (LD1 - Linear Discriminant 1) has the highest class separation onto the second discriminant axis (LD2). When LDA is used for dimensionality reduction, the data can be projected on the first two axes, and the remaining axes are discarded. LDA shows that the separation between the five groups on the x axis is fair (54%), but not optimal on the y axis (25%). The first group of students (N=633), appearing in black, mentioned mainly the atmosphere. The second group (N=1,054), appearing in red, did not mention any specific characteristics. The third group (N=595), appearing in green, mentioned mostly exercise. The fourth group (N=838), appearing in royal blue, mentioned teacher; and the fifth group, appearing in dark blue, mentioned teacher and exam (N=340). In addition, group number One (black) is less separated from the other groups since students that mentioned the atmosphere also mentioned the teacher and exercise that created it. According to LDA, the separation percentages are: LD1 -54%, LD2 -25%, LD3 -16%, LD4 -3%. Figure 4 shows separation on the horizontal axis using LD1 and on the vertical axis using LD2.

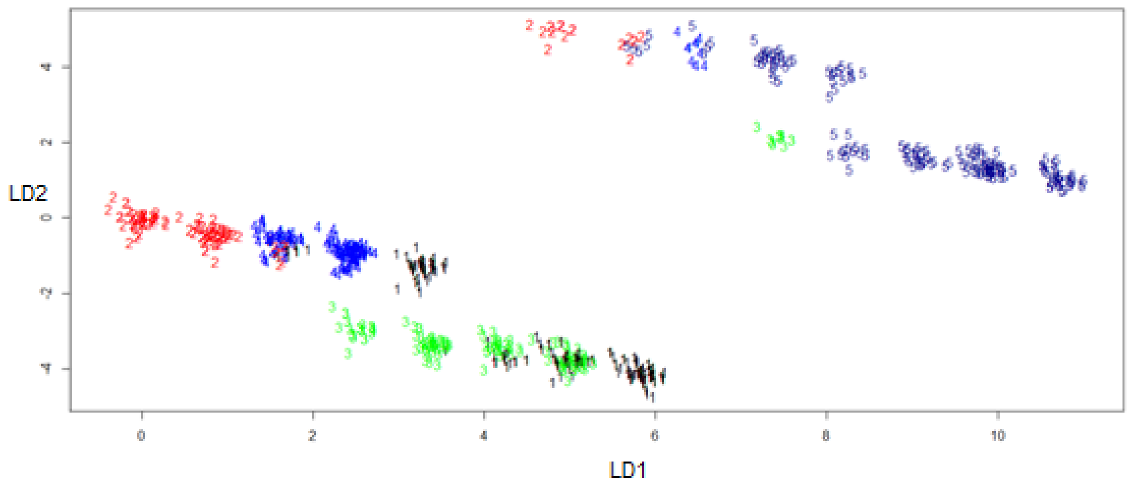


Figure 4. Student groups by mentioned characteristics

It can be seen that the students were grouped into five groups based on the characteristics that they mentioned in the reviews: atmosphere, exercise, teacher, exam, or none. These characteristics were divided between the social, cognitive, and teaching presence categories. These results are aligned with the theoretical model by Shea and Bidjerano (2010) that adds learning presence to the CoI model by Garrison et al. (2000). Learning style models have been very common in the literature for many years (Curry, 1983). Students' review data was used to find that the students can be partitioned into groups according to the characteristics that they mentioned, which in turn can indicate their learning style. A good separation (although not perfect) was found between the different groups of students. This level of separation among the groups can be explained by the fact that many students have more than one preference. This is aligned with Lujan and Dicarlo (2006), who claim that most students have multiple learning styles, and with Kraetzig and Arbuthnott (2006), who found that students use different combinations of learning models to learn effectively. An exception to the clear separation is the group of students that preferred the atmosphere characteristic (first group) and gave significant values to the teacher and exercise characteristics. In this case, it is assumed that the atmosphere is created by the teacher and the exercise.

It should be noted that forum characteristics, which might represent collaboration between learners, was identified as a contributor to MOOC success. This is in alignment with the CoI model which is based on collaborative-constructivist theory. Collaborative learning is usually associated with activities on forums or joint work on tasks or projects. However, the cluster analysis grouped the learners based on atmosphere, exercise, teacher, and exam characteristics, while forum characteristics was not identified as representing one of the learner groups and project characteristics was not mentioned explicitly.

Qualitative Analysis of Student Reviews in Each Revealed Group

Each group of students that was found in the quantitative analysis previously presented was mostly characterized by one presence. In this section, a thorough description of these groups will be given by using a qualitative analysis of the students' reviews. The reviews were analyzed according to the characteristics that were identified as dominant in each group: atmosphere, exercise, teacher, and exam. Notably, each review could possibly contain a description of more than one characteristic.

The group that perceived the importance of atmosphere for course success

This group of students emphasized the importance of the atmosphere characteristic. The students in the Python course mentioned the importance of humor, fun, and games in improving their learning capabilities. The following citation illustrates this perception:

"It was fantastic. The instructors were engaging, funny and thorough. They always look like they're having so much fun! I learned a lot about Python and how to write code for interactive games."

Additionally, in the same group, the students in the Epidemics course mentioned the importance of entertainment by using different kinds of video and animation to help students focus their attention:

"I'd taken a few other [C]oursera courses before this one but this [was] by far the most entertaining and engaging course. The animations in the videos and the different instructors keep your attention and help make the more difficult concepts easier to understand."

The students in the Environment course mentioned the added value in communication with students around the globe:

"Great experience! Highly recommend this to anyone… It was interesting to read student feedback as students were from around the world and from different walks of life."

The students of the Solar System course mentioned the importance of the combination between interesting material, the teacher's in-depth knowledge and passion, and humor, which helped engage students in learning:

"This is a phenomenal course. Mike Brown is a passionate professional in this field and brings both knowledge and wry humor to the subject. The material presented is absolutely fascinating and leaves you hungering [hungry] *for more!"*

Finally, the students in the Management course mentioned the importance of engaging the curiosity of the students:

"*In each of the modules covered, Prof*[essor] *Terwiesch was very good at engaging us to learn and exciting us with curiosity to calculate those seemingly very complex and difficult operational problems."* [This quotation was edited for grammar]

In all of the researched courses there were students that emphasized the importance of enjoyment as a significant factor in learning engagement. A variety of methods contributed to students' enjoyment of the different courses. The courses used humor, games, curiosity, animation, interesting video, various instructors, and more.

In the group that mentioned the atmosphere characteristic as significant for learning, it can be seen that for many of the students, atmosphere is composed of humor and of additional components such as curiosity, diversity, and interest. The importance of humor, engagement, and curiosity for this group of students is in accordance with other research (Harasim, 2000; Mclnnerney & Roberts, 2004; Poole, 2000) that identified the sense of belonging to community as a significant component that affects student participation, engagement, and attitude towards online learning. As well, Han and Johnson (2012) found correlation between emotional intelligence and social connections and between interactions in online learning.

The group that perceived the importance of exercise for course success

This group represents students that perceived the importance of the exercise characteristic. Students from the Python course mentioned that exercise, which includes building games, is a motivator for learning. In addition, they said that even though the course included intensive work, the enjoyment of building the project created motivation for the exercise and resulted in a significant learning experience:

"What makes the course engaging is that it uses game programming as the basis for homework and project assignments. ...I actually learned some interesting things I wasn't expecting to learn."

"Instead of developing complex[,] statistical algorithms, the professors make you write (and evaluate) games!"

Students from the Epidemiology course also mentioned the importance of games and animation as motivators to complete the exercises and learn during the course. They found that the games created motivation for investing more hours in doing exercises that they enjoyed, which contributed to the learning.

"…try out the mobile/Simulation Vax game, you would definitely put in more workload hours and find this course even more enjoyable."

The students from the Environment course agreed that the lack of exercises hurt their learning experience. However, the students in the Solar System course mentioned that the challenging exercise was very satisfying, due to the feeling of having successfully coped with the challenge, and they emphasized that it caused them to experience satisfaction from the learning. They also emphasized that there was a particular level of complexity that enabled the exercise to be difficult but not impossible and that contributed to their satisfaction from the learning.

"At first, I had some doubts about the type[s] of questions in the homework. I've decided they [were] more thoughtfully crafted than I [had] originally thought. The course requires more time and application than I expected. Also[, it] leaves me feeling more satisfied than I would have [felt] otherwise."

"Each homework [assignment] is pitched (IMHO) at the right difficulty to make me think, but not to discourage me from returning week after week."

Moreover, the students in the Management course described two different methods of exercise in their course. The first method included a project with a practical implementation that contributed to students' learning. The second method included a questionnaire for students that preferred a lighter workload that contributed to learning course terminology.

"I took the easy route and just completed the course by doing the homework and not by performing the case study (which is much more rewarding but a lot more work!). I found the homework to be very easy and fast because Prof. Terwiesch had similar examples in his lectures. He clearly wanted the course to be very accessible to all." (This quotation was edited for grammar)

It can be concluded that the courses that had exercises involving games resulted in positive student engagement, extensive investment, and deep understanding of the material. In addition, the students mentioned that challenging but level-appropriate exercises caused a feeling of achievement. Moreover, students that elected to complete the practical project experienced a significant learning experience, while students in courses that lacked challenging exercises described them as needing improvement.

Many of the students in this group, which mentioned the exercise characteristic as an enabler of significant learning, found that the game exercises resulted in engagement, significant investment, and deeper understanding of the learning material. Moreover, the students mentioned that challenging but reasonable exercises generated a feeling of achievement. Students that selected practical projects as exercises experienced significant learning. This finding is in alignment with Cook (2005), who claims that teaching methods that involve interactive games might fit the requirements of active students, according to the definition of LSI by D. Kolb (1985), who are expected to be more successful in an online interactive learning environment.

The group that perceived the importance of teacher for course success

This group emphasized the importance of the teacher characteristic. The instructor was found to be a dominant factor for MOOC success in all the courses used for this study. Students from the Python course stated the importance of teachers who use entertainment and humor in their teaching for the purpose of engaging students; additionally, the creation of a challenge, clear explanations, and creation of the feeling that the tasks are feasible were important.

"The teaching staff was fabulous and [they] designed [the] course in a way that we never feel that things are getting out of reach..."

"... and because of the funny and engaging teaching style[,] it's never boring."

The students in the Epidemiology course mentioned the added value in the variety of instructors. They also emphasized the importance of the teachers' expertise, their enthusiasm, and the quality of their explanations. They mentioned the thorough coverage of subjects and the combination between theory and practical examples.

"Absolutely loved the way the instructors taught and explained. Each had their own style and enthusiasm."

"Professors covered a wide range of topics and strengthened the impact of presented theory with well-chosen, real world case studies. Great to have a class taught by so many different experts!"

The students in the Environment course mentioned the fact that the teacher explained complex ideas in a simple manner, created a pleasant atmosphere, and was available to respond to questions in the forum.

"I enjoyed the course very much and the instructor explained the complex phenomena in such an easy way that I was able to clearly understand the concepts." (This quotation was edited for grammar)

"Professor Friedland's easy manner made the learning experience not just unintimidating, but pleasant. The professor and staff engaged constructively in the discussion forum."

Additionally, the students in the Solar System course emphasized the enthusiasm the teacher had for the subject he was teaching, his ability to create curiosity among students by asking questions, his thorough knowledge, and his ability to engage students in the learning.

"Prof. Mike brings his passion for astronomy to every lecture[;] it will leave you with more answers, and more questions [than] you ever dreamed [of]."

"The instructor is engaging and knowledgeable..."

The students in the Management course also mentioned the importance of enjoyment in learning, of humor, of clear explanations, and of practical examples.

"I had [a] fantastic time learning with Prof. Terwiesch! His humor was hilarious and he made the course very interesting and pertinent with everyday examples."

The students who mentioned the teacher characteristic as central to the learning process described the contributing elements: engagement of students by using humor, entertaining, good atmosphere, creating a feasible challenge, explaining complex concepts in a simple manner, and participating in the forum. From the analysis of the reviews one can understand the importance of the teacher characteristic to these students. This finding is aligned with Garrison and Cleveland-Innes (2005), who claim that teaching presence provides the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes. It is also aligned with Cook (2005), who claims that online learning will fit the reflective student, according to the LSI definition by D. Kolb (1985), due to the asynchronous and independent nature that allows the student to progress at his/her own pace.

The group that perceived the importance of exam for course success

This group of students emphasized the importance of the exams for course success.

The students in the Python course mentioned the complexity of the quizzes, which prepared them for higher quality learning. The same is true for the alignment between the quizzes and the projects, which enabled the students to learn the subject, build the project, and understand the course material.

"The amount of material offered, in term[s] of quizzes, mini-projects[,] and pedagogical tools, is pretty phenomenal for a MOOC... The quizzes are usually longer, better elaborated[,] and more complex than what I've seen elsewhere."

"…every question on the quiz was aimed to help with [the] mini-projects!"

The students in the Epidemiology course mentioned the importance of quiz complexity, which enabled thorough learning. In addition, the flexibility of the schedule for completing the tests allowed the students to close the learning gap.

"The quizzes were challenging and made me really think."

"Furthermore, the flexible quiz deadlines did not exert pressure on me, so I had the opportunity to determine the time I wanted to allocate to each module according to my schedule and complete the quizzes when I wanted."

The students in the Environment course also said that the exams helped in understanding and structuring learning.

"They check your understanding and weekly quizzes help us to reinforce whatever we have learned."

The students in the Solar System course mentioned that the quizzes tested their understanding thoroughly and did not simply repeat the lecture content.

"The quizzes weren't the usual bland checks [of information] that one had listened to [during] the lectures[,] but required me [to] really examine what I thought I knew. The inter lecture questions really helped me stay on track."

Finally, the students in the Management course mentioned the combination between lectures, examples, exercises, and quizzes.

"There are plenty of examples in the lectures and more for practice at home. These examples helped me solve the assignment questions."

The group of students that mentioned the exam characteristic as significant to the learning process emphasized the importance of the complexity of the quizzes and the importance of the connection between the lectures, the exercises, and the tests for structured learning. Here, also, the qualitative analysis helps to understand the nature of the exam characteristic as a contributor to learning. This is aligned with Howland and Moore (2002), who suggest that online courses enable flexibility for students that need more feedback and scaffolds, and with Mupinga, Nora, and Yaw (2006), who recommend performing exams frequently to enable consistency. To support this they recommend automatic or peer reviewed exams.

The qualitative analysis of students' reviews strengthens the quantitative findings regarding the student groups that were identified. The student groups preferred atmosphere, exercise, teacher, and exam. However, in most cases, students from all the groups mentioned one or more of the following characteristics in their review: atmosphere, teacher, course content and organization, exam, complexity, workload, exercise, illustration tools, and forum. For example, the following review that is related to the group that mentioned exercise as an important characteristic, also mentioned teacher, course content and organization, forum, workload, and auxiliary material characteristics: "Wonderful presentation, interesting facts, and this course had something for everyone. If you decided to read the extra recommended articles, participate in the various thought provoking discussion boards, or try out the mobile/Simulation Vax game, you would definitely put in more workload hours and find this course even more enjoyable. Great job to the entire team! I have prior medical education and experience and this course was not as technical as a few other science courses that I previously completed through Coursera."

Conclusions

The findings show that the characteristics that contribute to successful MOOCs are teacher, exercise, atmosphere, and workload. These characteristics are part of the three CoI model presence elements: teaching, social, and cognitive. In the analyzed MOOCs the three presence elements have significant values (teaching 36%, social 23%, and cognitive 36%). Similarly, the students were clustered into three groups (teaching, social, and cognitive), indicating their main preferences. These findings negate the perception that xMOOCs mostly contain teaching presence elements.

The qualitative analysis of students' reviews shows that many participants, taking part in the same course, mentioned different characteristics that contributed to their learning. The characteristics students chose to mention may indicate their learning preference. In addition, there are students that mentioned a few characteristics that contributed to the success of the course, yet only a few students mentioned a single characteristic. This is aligned with the quantitative analysis that found an overlap between the groups, with Lujan and DiCarlo (2006), who found that most students prefer to use more than one form of data presentation, and with Grünewald et al. (2013), who claim that MOOCs contain video presentation, text, and opportunities to take an active part in learning and social interaction, enabling the support of different learning styles. Furthermore, it can also be seen that the students were more appreciative of the learning when the course was more challenging and it strengthened their self-efficacy.

The current research identified, sorted, and mapped the characteristics of good MOOCs according to the CoI model in order to assist in improving MOOCs development and teaching and, consequently, will contribute to implementation and research of better MOOCs. Furthermore, the identification of students' characteristics sheds light on students' learning styles and preferences, which may assist in better matching of MOOCs to students' needs.

Future research could analyze how MOOCs allow students to consume content according to their different preferences, as well as using students' online reviews to improve MOOC pedagogy.

Additionally, since the CoI model is based on collaborative-constructivist theory and since forum characteristics might represent collaboration between learners, it was identified as a contributor to MOOC success. However, the findings clustered the learners into groups based on atmosphere, exercise, teacher, and exam characteristics, which do not represent collaborative learning; therefore, further research is needed to focus on analyzing the reviews that may be associated with collaborative learning.

These finding are different from the common perception that MOOCs contain mostly teaching presence elements (Guo, Kim, & Rubin, 2014), and they comply with Ally (2004), who foresees that online learning material will be designed in small, coherent slices to allow for redesign according to different students and different contexts. The findings also comply with Ocepek, Bosnić, Šerbec, and Rugelj (2013), who claim that learning style is the most important parameter in the students' selection of online materials.

Due to these findings, we recommend that MOOC scholars and implementers take into account the different learning styles of students when designing and researching MOOCs, so that the learning material will allow students to choose between teaching, social, and cognitive presence elements. Such a design will enable the students to maximize the benefits of MOOCs.

References

Ally, M. (2004). Foundations of educational theory for online learning. *Theory and practice of online learning*, *2*, 15-44.

Anderson, T., & Dron, J. (2010). Three generations of distance education pedagogy. *The International Review of Research in Open and Distributed Learning, 12*(3), 80-97.

Arbaugh, J. B., Cleveland-Innes, M., Diaz, S. R., Garrison, D. R., Ice, P., Richardson, J. C., & Swan, K. P. (2008). Developing a community of inquiry instrument: Testing a measure of the community of inquiry framework using a multi-institutional sample. *The Internet and Higher Education*, *11*(3), 133-136.

Barber, M. (2013). Comment posted on the Introduction to Operations Management page. Coursetalk.org: http://coursetalk.org/coursera/an-introduction-to-operations-management

Christensen, G., Steinmetz, A., Alcorn, B., Bennett, A., Woods, D., & Emanuel, E. J. (2013). *The MOOC phenomenon: Who takes massive open online courses and why?* Available at SSRN 2350964.

Claxton, C. S., & Murrell, P. H. (1987). *Learning styles: Implications for improving educational practices. ASHE-ERIC higher education report No. 4, 1987*. Association for the Study of Higher Education.

Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004). *Learning styles and pedagogy in post 16 learning: A systematic and critical review*. The Learning and Skills Research Centre.

Cohn E. (2014). *Epidemics MOOC: Expanding free access to education*. Retrieved from http://www.healthmap.org/site/diseasedaily/article/epidemics-mooc-expanding-free-access-education-92414

Conole, G. (2013). MOOCs as disruptive technologies: Strategies for enhancing the learner experience and quality of MOOCs. *Revista de Educación a Distancia*, *39*, 1-17.

Cook, D. A. (2005). Learning and cognitive styles in web-based learning: Theory, evidence, and application. *Academic Medicine*, *80*(3), 266-278.

Curry, L. (1983). A critique of the research on learning styles. *Educational Leadership, 48*(2), 50–56.

Dabbagh, N., Benson, A. D., Denham, A., Joseph, R., Al-Freih, M., Zgheib, G., ... & Guo, Z. (2016). Massive Open Online Courses. In *Learning technologies and globalization* (pp. 9-13). Springer International Publishing.

Daniel, J. (2012). *Making sense of MOOCs: Musings in a maze of myth, paradox and possibility*. Seoul: Korean National Open University. Retrieved from http://jime.open.ac.uk/articles/10.5334/2012-18/

Dillahunt, T. R., Wang, B. Z., & Teasley, S. (2014). Democratizing higher education: Exploring MOOC use among those who cannot afford a formal education. *The International Review of Research in Open and Distributed Learning*, *15*(5).

Drago, W. A., & Wagner, R. J. (2004). Vark preferred learning styles and online education. *Management Research News*, *27*(7), 1-13.

Duff, A. (2004). Understanding academic performance and progression of first-year accounting and business economics undergraduates: The role of approaches to learning and prior academic achievement. *Accounting Education*, *13*(4), 409-430.

Entwistle, N. J., & Peterson, E. R. (2004). Conceptions of learning and knowledge in higher education: Relationships with study behaviour and influences of learning environments. *International Journal of Educational Research*, *41*(6), 407-428.

Felder, R. M., & Silverman, L. K. (1988). Learning and teaching styles in engineering education. *Engineering education*, *78*(7), 674-681.

Freitas, S. I., Morgan, J., & Gibson, D. (2015). Will MOOCs transform learning and teaching in higher education? Engagement and course retention in online learning provision. *British Journal of Educational Technology*, *46*(3), 455-471.

Garrison, D. R. (2009). Communities of inquiry in online learning: Social, teaching and cognitive presence. In P. Rogers et al. (Eds.), *Encyclopedia of distance and online learning* (2nd ed., pp. 352-355). Hershey, PA: IGI Global.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical thinking in text-based environment: Computer conferencing in higher education. *The Internet and Higher Education, 2*(2), 87-105.

Garrison, D. R., Anderson, T., & Archer, W. (2010). The first decade of the community of inquiry framework: A retrospective. *The Internet and Higher Education*, *13*(1), 5-9.

Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: Review, issues, and future directions. *The* Internet *and Higher Education*, *10*(3), 157-172.

Garrison, D. R., & Cleveland-Innes, M. (2005). Facilitating cognitive presence in online learning: Interaction is not enough. *The American Journal of Distance Education*, *19*(3), 133-148.

Greene, J. A., Oswald, C. A., & Pomerantz, J. (2015). Predictors of retention and achievement in a massive open online course. *American Educational Research Journal* (Advance online publication). doi: 10.3102/0002831215584621

Gregorc, A. F., & Ward, H. B. (1977). A new definition for individual. *Nassp Bulletin*, *61*(406), 20-26.

Grünewald, F., Meinel, C., Totschnig, M., & Willems, C. (2013). Designing MOOCs for the support of multiple learning styles. In *Scaling up learning for sustained impact* (pp. 371-382). Springer Berlin Heidelberg.

Guo, P. J., Kim, J., & Rubin, R. (2014, March). How video production affects student engagement: An empirical study of mooc videos. In *Proceedings of the first ACM conference on Learning@ scale conference* (pp. 41-50). ACM.

Han, H., & Johnson, S. D. (2012). Relationship between students' emotional intelligence, social bond, and interactions in online learning. *Educational Technology & Society*, *15*(1), 78-89.

Harasim, L. (2000). Shift happens: Online education as a new paradigm in learning. *The Internet and Higher Education*, *3*(1), 41-61.

Howland, J. L., & Moore, J. L. (2002). Student perceptions as distance learners in Internet-based courses. *Distance Education*, *23*(2), 183-195.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, *33*(7), 14-26.

Kaufman, L., & Rousseeuw, P. J. (2009). *Finding groups in data: An introduction to cluster analysis* (Vol. 344). John Wiley & Sons.

Klecka, W. R. (1980). *Discriminant analysis* (No. 19). Sage.

Kolb, A. Y. (2005). *The Kolb learning style inventory—version 3.1 2005 technical specifications*. Boston: MA.

Kolb, D. A. (1985). Learning styles inventory. Boston: McBer.

Konrad, W. (2015, March 19). Free Online Courses Keep Retirees in the Know. *The New York Times*. Retrieved from http://nyti.ms/1C1WGse

Kozan, K. (2016). The incremental predictive validity of teaching, cognitive and social presence on cognitive load. *The Internet and Higher Education, 31,* 11-19. doi:10.1016/j.iheduc.2016.05.003

Kraetzig, G. P., & Arbuthnott, K. D. (2006). Perceptual learning style and learning proficiency: A test of the hypothesis. *Journal of Educational Psychology*, *98*(1), 238.

Lovins, J. B. (1968). *Development of a stemming algorithm*. MIT Information Processing Group, Electronic Systems Laboratory.

Lujan, H. L., & DiCarlo, S. E. (2006). First-year medical students prefer multiple learning styles. *Advances in Physiology Education*, *30*(1), 13-16.

McAuley, A., Stewart, B., Siemens, G., & Cormier, D. (2010). *The MOOC model for digital practice.*

McInnerney, J. M., & Roberts, T. S. (2004). Online learning: Social interaction and the creation of a sense of community. *Educational Technology & Society*, *7*(3), 73-81.

Mills, J., Yates, K., Harrison, H., Woods, C., Chamberlain-Salaun, J., Trueman, S., & Hitchins, M. (2016). Using a community of inquiry framework to teach a nursing and midwifery research subject: An evaluative study. *Nurse Education Today*, *43*, 34-39.

Mupinga, D. M., Nora, R. T., & Yaw, D. C. (2006). The learning styles, expectations, and needs of online students. *College Teaching*, *54*(1), 185-189.

Neuhauser, C. (2010). Learning style and effectiveness of online and face-to-face instruction. *The American Journal of Distance Education, 16*(2), 99-113.

Ocepek, U., Bosnić, Z., Šerbec, I. N., & Rugelj, J. (2013). Exploring the relation between learning style models and preferred multimedia types. *Computers & Education*, *69*, 343-355.

Pappano, L. (2012, November 2). The year of the MOOC. *The New York Times*.

Poole, D. M. (2000). Student participation in a discussion-oriented online course: A case study. *Journal of Research on Computing in Education, 33*(2), 162-177.

Raban, C. (2007). Assurance versus enhancement: Less is more?. *Journal of Further and Higher Education*, *31*(1), 77-85.

Ravenscroft, A. (2011). Dialogue and connectivism: A new approach to understanding and promoting dialogue-rich networked learning. *The International Review of Research in Open and Distance Learning, 12*(3), 139-160.

Richardson, J. T. (2000). *Researching student learning: Approaches to studying in campus-based and distance education*. Open University Press.

Shelton, K. (2011). A review of paradigms for evaluating the quality of online education programs. *Online Journal of Distance Learning Administration, 14*(1).

Shea, P., & Bidjerano, T. (2010). Learning presence: Towards a theory of self-efficacy, self-regulation, and the development of a communities of inquiry in online and blended learning environments. *Computers & Education*, *55*(4), 1721-1731.

Siemens, G. (2012, July 25). MOOCs are really a platform [Blog post]. elearnspace. Retrieved from http://www.elearnspace.org/blog/2012/07/25/moocs-are-really-a-platform/

Siemens, G. (2013). Massive open online courses: Innovation in education? In R. McGreal, W. Kinuthia & S. Marshall (Eds.), *Open educational resources: Innovation, research and practice* (pp. 5-16). Vancouver: Commonwealth of Learning and Athabasca University.

Smith D. (2015). Mike Brown's "living textbook". Retrieved from http://www.caltech.edu/news/mike-browns-living-textbook-46942

Weinzimmer, S. (2012). Rice's first Coursera class enrolls 54,000. *The Rice Thresher.* Retrieved from http://www.ricethresher.org/rice-s-first-coursera-class-enrolls/article_674ea036-6aa6-59c9-99dd-08910d1fb68d.html

Yuan, L., & Powell, S. (2013). *MOOCs and open education: Implications for higher education*. Cetis White Paper. Centre for Educational Technology, Interoperability and Standards and JISC. Retrieved from http://publications.cetis.ac.uk/2013/667

Biographies

Simona Holstein is a Graduate student at Tel-Aviv University's School of Education, at the Math, Science, and Technology Education Department. Mrs. Holstein holds a BSc. in Computer Science from the Technion - Israel Institute of Technology. Her thesis deals with the characteristics that contribute to successful MOOC courses in Software, Science, and Management domains according to students perception, under the supervision of Dr. Anat Cohen. She has vast experince in technology form her 20 years work in the Hi-tech industry in the fields of web and telecommunication, and is enthusiastic about engaging open data for education by leading a project at the The Public Knowledge Workshop a non-profit organization that creates software to support meaningful engagement with public data.

Dr. Anat Cohen (PhD) is a senior academic staff member (on tenure track) at Tel Aviv University at School of Education; Head of the Learning and Technology program in The Department of Education in Mathematics, Science and Technology; A research and pedagogical coordinator of Web-Supported Academic Instruction at Tel-Aviv University. Dr Cohen's dissertation analysed the cost-effectiveness of Web-based Education, based on theoretical and computational models and empirical data using web-mining techniques. She has vast experience in research and teaching in the field of learning and cyber technologies after 14 years of development of online learning materials, training of academic staff, characterization of learning-management features fit to the University's needs, as well as research activities focusing on research areas such as social networks and privacy perception on the cyber space, internet implementation in higher education, innovative pedagogical practices using ICT, open educational resources (Learning object repositories and MOOCs), learning analytics and educational data mining.

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Blau, I. & Benolol, N. (2016). Can designing self-representations through creative computing promote an incremental view of intelligence and enhance creativity among at-risk youth? *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 267-278. Retrieved from http://www.informingscience.org/Publications/3577

Can Designing Self-Representations through Creative Computing Promote an Incremental View of Intelligence and Enhance Creativity among At-Risk Youth?

Ina Blau
The Open University of Israel, Ra'anana, Israel

inabl@openu.ac.il

Nurit Benolol
Beit Berl College, Kfar Saba, Israel

nurit.benolol@beitberl.ac.il

Abstract

Creative computing is one of the rapidly growing educational trends around the world. Previous studies have shown that creative computing can empower disadvantaged children and youth. At-risk youth tend to hold a negative view of self and perceive their abilities as inferior compared to "normative" pupils. The Implicit Theories of Intelligence approach (ITI; Dweck, 1999, 2008) suggests a way of changing beliefs regarding one's abilities. This paper reports findings from an experiment that explores the impact of a short intervention among at-risk youth and "normative" high-school students on (1) changing ITI from being perceived as fixed (entity view of intelligence) to more flexible (incremental view of intelligence) and (2) the quality of digital self-representations programmed though a creative computing app. The participants were 117 Israeli youth aged 14-17, half of whom were at-risk youth. The participants were randomly assigned to the experimental and control conditions. The experimental group watched a video of a lecture regarding brain plasticity that emphasized flexibility and the potential of human intelligence to be cultivated. The control group watched a neutral lecture about brain-functioning and creativity. Following the intervention, all of the participants watched screencasts of basic training for the Scratch programming app, designed artifacts that digitally represented themselves five years later and reported their ITI. The results showed more incremental ITI in the experimental group compared to the control group and among normative students compared to at-risk youth. In contrast to the research hypothesis, the Scratch projects of the at-risk youth, especially in the experimental condition, were rated by neutral judges as being more creative, more aesthetically designed, and more clearly conveying their message. The results suggest that creative computing combined with the ITI intervention is a way of developing creativity, especially among at-risk youth. Increasing the number of youths who hold incremental views of intelligence and developing computational thinking may contribute to their empowerment and well-being, improve learning and promote creativity.

Keywords: creative computing, creative coding, creative programming, scratch application, implicit theories of intelligence, constructionism, at-risk youth, normative high-school students

Editor: Janice Whatley

An earlier, shorter version of this paper was presented at the Chais conference 2016, in Raanana, Israel, and included in Y. Eshet-Alkalai, I. Blau, A. Caspi, N. Geri, Y. Kalman, & V. Silber-Varod (Eds.), *Proceedings of the 11th Chais Conference for the Study of Innovation and Learning Technologies 2016: Learning in the Technological Era*. Raanana: The Open University of Israel.

Introduction

One of the prominent trends in recent years, in relation to the use of educational technologies in formal and informal learning environments for children and youth around the world, is called "creative computing" (Yang & Zhang, 2016), "creative coding" (Bergstrom & Lotto, 2015) or "creative programming" (Park, 2016).

Creative computing is not a new idea, but rather, the refinement of a previous approach that was abandoned. Learning programming tools like Basic, Logo, and Pascal were widespread educational systems in the 1980s (Papert, 1980), but were discarded in the 90s with the rise of the Internet (Kafai & Burke, 2015). Today, efforts are being invested in designing apps that enable the construction of digital artifacts with a minimum requirement of prior programming knowledge. Contemporary programming applications, such as Scratch Online, Planet Kodu, CodeMonkey, Alice, Newgrounds, Looking Glass, and EJS, encourage young people to program, not as a way of learning programming per se, but rather, as an opportunity to create and share their ideas and digital artifacts with other users through the network (Brennan & Resnick, 2012; Zuckerman, Blau, & Monroy-Hernández, 2009). Indeed, to emphasize this point we have chosen to use the term "creative computing" in our paper rather than coding or programming. These current applications effectively combine programming learning with participation in an online community and allow teens to create and share their interactive projects, ranging from digital storytelling, simulations, and games, to programmable digital clothes (Brennan, Chung, & Hawson, 2011; Kafai & Burke, 2015). Resnick, the head of the MIT Media Lab, who developed the Scratch app (http://scratch.mit.edu/) used in our study, claimed that this technology teaches children to be creative and to think in a structured and collaborative way (Flanagan, 2015). However, based on a review of 27 available intervention studies, Lye and Koh (2014) called for more K-12 intervention studies centering on computational practices and the computational perspectives of students.

This paper reports findings from an experiment among at-risk youth and "normative" high-school students that explores the impact of a short creative computing intervention on their perception of intelligence as either fixed or incremental and on the quality of digital self-representations programmed though a creative computing app.

Frameworks and Literature Review

The theoretical framework underlying this trend of creative computing is a learning approach called *Constructionism* (Papert, 1980). According to this learning theory, people learn more effectively while creating tangible outcomes, both physical environments and digital artifacts. This approach emphasizes the importance of facilitating students' use of technology as 'building material' to create digital outcomes or artifacts. Papert claimed that in the process of creating these outcomes, over time, digital devices become 'objects to think with'; they enable students to learn how to learn and how to solve problems.

The learning experiences offered by creative computing applications are in line with recent arguments on the importance of developing *computational thinking,* the use of concepts from the domain of computer science and programming to solve problems in other domains (Sharples et al., 2015). The term, "computational thinking" was initially used by Papert (1996) in order to emphasize the inherently interdisciplinary nature of computing and its potential to engage learners in new ways of thinking. Thus, the goal of designing computational artifacts is not to prepare future programmers, but rather to develop computational thinkers who can confidently cope with complexity and with open-ended problems and transfer computational perspectives across contexts and disciplines (Grover & Pea, 2013; Sharples et al., 2015; Wing, 2006). According to Sharples and colleagues (2015), when dealing with a variety of problems, computational thinking involves internalization of the following steps: decomposition of a large problem into smaller ones, recognition of patterns used in the past to solve these problems, identification of unimportant details and setting them aside, designing and refining the steps necessary to reach a solution, debugging these steps, and presenting a solution in a usable form.

Moreover, creative computing is an important design activity which gives youth a real opportunity to '*learn by design*' and to build important 21st century digital literacy competences within the context of a complex design project (Blau & Shamir-Inbal, 2016; Brennan & Resnick, 2012). Instead of technical details of computation, creative computing emphasizes the interests of youth, their vivid imagination, and the realization of their creative potential (Benolol & Blau, 2016; Blau, Zuckerman, & Monroy-Hernández, 2009; Kafai, 2016). It helps in developing competences and literacies that youth need to become producers and designers of dynamic media and interactive digital outcomes and that they can enjoy on a daily basis (Blau & Peled, 2015; Eshet-Alkalai, 2012; Park, 2016; Shamir-Inbal & Blau, 2014, 2016a, 2016b). Although the importance of 'learning by design' is widely accepted (Kafai & Burke, 2014, 2015; Ke, 2014; Peppler & Kafai, 2007), school students have little experience in following the design process from beginning to end, which involves researching, planning, problem-solving, dealing with time constraints, modifying expectations, and bringing different parts of the project together (Kafai, 2016).

One of the populations that may especially benefit from creative computing is *at-risk youth.* Previous studies have shown (Benolol & Blau, 2016; Mahiri 2011; Parker 2008; Peppler & Kafai, 2007; Watkins, 2009) that creative computing can improve the self-esteem of children and youth who are disadvantaged for demographic reasons, such as their ethnic origin, cultural background, or socio-economic status. In the education system, at-risk youth are often marginalized and are characterized by academic failure, violent behavior, and lack of involvement in school activities (Blau & Barzel-Rubin, 2013; Dishion, Véronneau, & Myers, 2010). As a result of rejection, at-risk youth develop a negative view of the self (McWhirter, McWhirter, McWhirter, & McWhirter, 2003). Resnick and Burt (1996) presented a conceptual framework that suggests four main components of "risk" among youth: (1) risk antecedents such as poverty, a delinquent social environment, and a dysfunctional family; (2) risk markers, such as dysfunction in school, including explicit or hidden dropout, and involvement in delinquent activities; (3) risk behaviors – frequent absences from school, frequently running away from home, sexual relationships at a young age, as well as early smoking, alcohol, and drugs use; (4) risk outcomes – early pregnancy and parenthood, homelessness, involvement in prostitution, drug and alcohol abuse, involvement in criminal activities, dropping out of the education system and local community, and disconnecting from them. These adolescences may feel that they belong neither to an interpersonal or social circle, and that they are not capable of adapting to either. The absence of social contact and engagement with social institutions results in low self-esteem, identity disorders, and a sense of alienation from society, its values and its institutions (Mekamel & Blau, 2014, 2016; Snyder, 2004).

One way to improve the self-perception of at-risk adolescents may be related to changing their perceptions regarding their intelligence. *Implicit Theories of Intelligence* (ITI; Dweck, 1999, 2008; Dweck, & Leggett, 1988) focuses on the human perception of intelligence as fixed or flexible and growing. According to this approach, the perceptions of people regarding their intelligence lie on the continuum between the perception of intelligence as fixed and unchanging throughout life (entity view of intelligence) and the concept of a flexible, evolving intelligence (incremental view). Empirical studies have shown that the perception of intelligence held by young participants creates a framework for the interpretation of events in their lives, and thus determines their behavior (Yeager, Trzesniewski, & Dweck, 2013).

Although both (entity and incremental) ITI are equally prevalent in the population and are typically stable over time and do not vary, either by gender (Robins, & Pals, 2002), or across national, ethnic or racial groups (Yeager et al., 2013), findings have shown that they can be influenced by specific teaching strategies through a short and simple intervention (Blackwell et al., 2007; Dweck & Master, 2008). In Blackwell et al.'s (2007) study, the experimental group received explanations regarding brain changes demonstrating that intelligence is flexible and can be developed. After this short intervention, the participants in the experimental group endorsed an incremental intelligence view more strongly than the participants in the control group who received neutral explanations regarding brain functioning. Adaptation of this intervention for changing students' ITI to a more incremental view was also successfully replicated in a different context, which led to changes in the participants' desire for vengeance in a social situation (Yeager et al., 2013). Half of the participants read a brief story about a student who was a victim of bullying in school, who learned from peers and adults that people's characteristics are changeable. Adolescents who received this incremental theory message, compared to those who read the same scenario without it, were significantly more likely to choose pro-social conflict solutions, such as explaining to the aggressors the effects of their actions, instead of choosing aggression against the bullies.

Research Goals and Hypotheses

The purpose of this study was to examine the possibility of transforming Implicit Theories of Intelligence regarding one's abilities from fixed (entity view) to more changeable (incremental view) among at-risk youth and normative students through the creation of programming representations of themselves in the future. The study also explored how the intervention to change ITI impacts the quality of digital artifacts: the clarity of conveying the represented idea, the quality of the programming, the creativity and originality of the artifact, as well as the aesthetics of its design.

The research hypotheses are:

1. Incremental *Implicit Theories of Intelligence* will be higher in the experimental group than in the control group, and among normative students compared to among at-risk youth. This is based on the ITI theory (Dweck, 1999, 2008) and previous findings showing that at-risk youth develop a negative view of the self (McWhirter et al., 2003). Additionally, we hypothesized that an interaction effect will be found between the type of participants and the experimental condition, so that the empowerment of at-risk youth through an incremental view of intelligence will be stronger in the experimental group.
2. Regarding *the quality of the creative computing* of self-representations in the future, we hypothesized that for four parameters of creative programming though the Scratch platform (clarity of the idea, quality of programming, creativity and originality, and aesthetics of the design), we will find that the quality of the normative students' digital artifacts will be rated as higher compared to that of the at-risk youth, and participants in the experimental group higher than participants in the control condition. Also, we hypothesized that an interaction effect would be found between the two variables, so that the quality of projects created by at-risk youth will be higher in the experimental group compared to all other groups following the manipulation of change in Implicit Theories of Intelligence.

Method

Participants

The participants were 117 youths from central Israel, 62 (53%) of whom were male. All of the participants were high school teenagers (Range: 14-17, Average: 14.98, SD: 0.73, Median and Mode: 15, Skewness: 0.232). Among the participants, 61 (52%) were at-risk youth who had dropped out of the education system; these participants were recruited from a special educational institution, which was designed for these teenagers as a substitute for formal schooling and which they attended as part of an at-risk youth program. The remaining participants were high school students who, for research purposes, were defined as “normative students”. School students with learning disabilities were excluded from the analysis.

The at-risk and “normative” participants were randomly assigned to experimental or control groups. The Scratch application for creative computing was new to all of the participants in the experiment.

Instruments and Procedure

Participants in both groups watched a short videotaped lecture related to brain activity. While in the experimental group the video highlighted the possibility for intelligence to change and evolve (Blackwell et al., 2007), the control group watched a neutral lecture about brain-functioning and creativity. After the intervention, both groups were asked to create a project using a creative computing application, Scratch, through which the participants were asked to present the way they see themselves in five years’ time. This instruction was inspired by previous findings regarding the importance of purpose in life for the wellbeing of adolescents in general (Damon, 2008; Heng & Blau, 2016) and disadvantaged adolescents in particular (Mariano, Going, Schrock, & Sweeting, 2011). In order to learn the basics of using the Scratch application, all participants watched the screencast tutorial explaining the basics of creative computing on Scratch before beginning to work on the project. These screencasts were developed by the Israeli Ministry of Education for educational purposes unrelated to the research.

Participants’ digital self-representations were saved and analyzed according to the following parameters: (1) clarity of the project’s idea (i.e., how clear it is to the viewer where the participant sees him or herself five years later), (2) quality of computing, (3) creativity and originality of the artifact, and (4) aesthetics of the design. These parameters were determined by the researchers after consultation with two experts in the field of creative computing. The programming quality of the projects was examined using an assessment applet on the Dr. Scratch website (http://drscratch.programamos.es/) on a scale from 1 to 11. The rating of the three other parameters mentioned above was performed on a scale ranging from 1- very slightly to 5- very much by a research assistant unaware of the research hypotheses. Out of all of the projects, 25% were independently rated by a second judge, and the degree of agreement between judges was good (Cohen’s Kappa range for various parameters κ=.86-.89).

After the participants finished working on the projects, they filled out a self-report questionnaire that included the Implicit Theories of Intelligence Scale (Dweck, 1999; Dweck & Henderson, 1988) and demographic data. The ITI scale is composed of three items: “You have a certain amount of intelligence, and you really can’t do much to change it”, “Your intelligence is something about you that you can’t change very much”, “You can learn new things, but you can’t really change your basic intelligence”. Agreement with each item indicates an entity view, while disagreement signifies an incremental view of intelligence. The report was on a scale from 1- strongly disagree to 6- strongly agree. Internal consistency reliability between the three statements was good, α=.82.

Note that we did not examine intelligence beliefs at baseline, since this was a relatively short experiment and, in addition to the demographic data, the self-report questionnaire the Implicit Theories of Intelligence Scale consists only of three items. Hence, if the ITI scale would have been administered twice, our participants could easily have remembered their ratings at baseline. One of the assumptions of experimental research design is that random assignment of participants to experimental conditions neutralizes differences between the groups; therefore we decided to only administer the ITI scale after the experiment.

Table 1 presents descriptive statistics for the dependent variables in the study – Implicit Theories of Intelligence and the four assessment parameters of the Scratch projects.

Table 1: Descriptive statistics for dependent study variables

		Assessment of Scratch self-representations			
	ITI	Clarity of the project's idea	Quality of programming	Creativity/Originality of the project	Aesthetics of the design
Average	3.95	3.74	3.46	3.01	2.96
Median	4	4	2	3	3
Mode	3	5	1	3	2
SD	1.33	1.36	2.84	1.13	1.20
Skewness	-0.332	-0.634	0.776	0.200	0.053
SE of skewness	.226	.224	.228	.224	.224
Minimum	1	1	1	1	1
Maximum	6	5	11	5	5

As shown in the table, the variables Implicit Theories of Intelligence, creativity and originality, and aesthetics of Scratch projects design, were normally distributed. In contrast, the clarity of the project's idea parameter is slightly tilted towards positive values, whereas the quality of the programming parameter is tilted towards lower values. In other words, the project idea was conveyed quite clearly, while the quality of programming was assessed as quite low (note that these are the projects of new users who were exposed to creative computing for the first time).

The research procedure was approved by the Institutional Ethics Committee. The experiment was conducted during the spring of 2015. The length of the procedure was two hours. At-risk youth carried out the experiment in the computer lab at the institution they attended as part of an at-risk youth program. Normative students participated in the experiment in the computer lab at their school. During the study, one of the researchers and one of the research assistants were present. The projects were saved on a portable disc for analysis and were not uploaded to the Scratch community website because of ethical considerations and in order to maintain the anonymity of the participants. Participants' self-report of ITI and the quality parameters of the digital self-representations were analyzed using the SPSS22 program.

Results

Implicit Theories of Intelligence

Table 2 presents descriptive statistics for the ITI measure according to the experimental condition and participant type – at-risk youth versus normative students.

Table 2: Descriptive statistics for ITI by experiment groups and type of the participants

Type of group	Type of participants	Average	SD	N
Experimental group	Normative students	4.37	1.35	28
	At-risk youth	3.96	1.55	29
	Total	4.16	1.46	57
Control group	Normative students	4.00	1.10	27
	At-risk youth	3.51	1.18	31
	Total	3.74	1.16	58
Total	Normative students	4.19	1.24	55
	At-risk youth	3.73	1.38	60
	Total	3.95	1.33	115

Results of a two-way ANOVA showed marginally significant differences in ITI, with participants in the experimental group perceiving intelligence as more changeable than participants in the control group ($F_{(1,113)}$=2.97, p=.08, η^2=.03). The main effect of the participant type was also marginally significant – normative students perceived intelligence as more malleable than at-risk youth ($F_{(1,113)}$=3.34, p=.07, η^2=.03). The acceptable effect sizes of both factors suggest that the tests might not have reached statistical significance because of the relatively small number of participants. No significant interaction effect was found between those two factors.

Assessment of the Scratch Project Parameters

Four ANOVA tests with the experimental condition and participant type as between-subjects variables were performed in order to examine the differences in the parameters of the digital projects, in which the participants symbolically represented themselves five years later using the Scratch creative computing environment. Table 3 shows the results of the descriptive statistics for the four tested parameters which measured the project quality.

Table 3: Average and SD values for projects parameters for at-risk and normative students

	Experimental group M (SD)			**Control group M (SD)**			**Total M (SD)**	
Parameters	Normative students	At-risk youth	Total	Normative students	At-risk youth	Total	Normative students	At-risk youth
Clarity of the idea	3.69 (1.47)	4.00 (1.08)	3.84 (1.28)	3.22 (1.57)	3.97 (1.22)	3.62 (1.44)	3.47 (1.52)	3.98 (1.15)
Quality of programming	3.62 (2.60)	3.60 (3.19)	3.61 (2.89)	3.81 (2.74)	2.81 (2.84)	3.30 (2.81)	3.71 (2.64)	3.23 (3.02)
Creativity and originality	2.76 (1.35)	3.43 (0.90)	3.10 (1.18)	2.74 (1.06)	3.06 (1.09)	2.91 (1.08)	2.75 (1.21)	3.24 (1.01)
Aesthetics of the design	2.62 (1.12)	3.63 (0.81)	3.14 (1.09)	2.92 (1.41)	2.64 (1.17)	2.78 (1.28)	2.77 (1.26)	3.13 (1.12)

Regarding the *clarity of the idea*, the analysis of variance showed a significant main effect for the participant type, in which, contrary to the hypothesis, at-risk youth were able to convey their project idea in a more comprehensible way than normative students ($F_{(1,113)}$=4.51, p=.036, η^2=.04). The experimental group effect and the interaction effect were not statistically significant.

For the *quality of programming* parameter, no significant difference was found between any of the groups.

As for the *creativity and originality* parameter, the analysis of variance showed a significant main effect for participant type. Contrary to the research hypothesis, the at-risk youth's projects were rated as significantly more creative than those of the normative students ($F_{(1,113)}$=5.88, p=.017, η^2=.05). The main effect for the experimental condition was not significant, but a significant interaction effect was found between the two factors ($F_{(1,113)}$=2.50, p=.048, η^2=.03). Namely, in the experimental group the at-risk youth's projects were rated as more creative than those of the normative students, while no difference in creativity was found between at-risk youth and normative students in the control group.

Concerning the *aesthetics of the design*, the analysis of variance showed a significant main effect for participant type: contrary to the research hypothesis, the design of the at-risk youth's self-representations was rated as significantly more aesthetic than that of the normative students

($F_{(1,113)}$=3.01, p=.038, η^2=.03). The main effect of the experimental group was not significant, but a significant interaction effect was found between the two factors ($F_{(1,113)}$=9.40, p=.002, η^2=.08). While in the experimental group at-risk youth created more aesthetic projects than normative students, no difference was found between at-risk youth and normative students in the control group.

Discussion and Conclusions

This paper examined change in perceptions of intelligence among at-risk youth and normative students in the context of a creative computing environment. Consistent with *the first research hypothesis* and similarly to previous studies (Blackwell et al., 2007; Yeager et al., 2013), we found that short and quite simple training can change Implicit Theories of Intelligence: youth can perceive intelligence as less fixed and more changeable and are able to evolve. As expected based on previous conceptualizations (Resnick & Burt, 1996) and findings regarding the characteristics of at-risk youth (Dishion et al. et al, 2010; McWhirter et al., 2003), the findings of the study indicated that they held a more fixed view of intelligence compared to normative students of the same age. However, contrary to the hypothesis, no interaction effect was found between the participant type (at-risk/normative) and the experimental condition.

As for creative computing, in contrast with *the second research hypothesis*, the findings showed a consistent advantage of at-risk youth over normative students. Namely, they were able to convey the idea for their digital self-representations more clearly and to create Scratch projects that were rated by a rater, who was unaware of the research hypotheses, as more creative and aesthetic. It therefore seems that, consistent with previous studies on the empowerment of youth who are disadvantaged as a result of socio-economic status or various demographic variables (Mahiri, 2011; Parker, 2008; Peppler & Kafai, 2007; Watkins, 2009), creative computing provides at-risk youth with an alternative channel to express their creativity and originality.

Moreover, in accordance with the second research hypothesis, the interaction effect between two factors indicated that in relation to quality parameters, such as the originality of the Scratch project and the aesthetics of its design, the advantage of at-risk youth over their normative peers is found only in the experimental group – after the intervention to change the Implicit Theories of Intelligence. Thus, it seems that the empowerment of students in general and at-risk youth in particular through creative computing is more effective when combined with training that emphasizes the ability of human intelligence to evolve (Benolol & Blau, 2016).

Implications and Future Work

The at-risk youth who study in special institutions are in an extremely complex situation. Many of them are not equipped with the necessary competences to succeed and advance on their own and are in need of guidance and support. Moreover, many of them do not have any appropriate role models in their close surroundings, and some find themselves lacking the basic trust in the people surrounding them and in their own abilities and potential to succeed in the future. At-risk youth need support and guidance along the way, so that they can utilize the tools that are being offered to them. Thus, to make learning effective for these students, we need to address their creative potential.

This pioneering research aimed to empower at-risk students by combining the potential of creative computing for this population reported in some projects led by the MIT research group, with an ITI intervention, which provides at-risk youth with a hope that despite their past, they can dream big dreams and have a desirable future. And indeed, this study shows that empowerment through an ITI intervention combined with creative computing allowed at-risk youth to express their creative potential beyond that of so called normative students. Future intervention projects among at-risk youth with greater and more extensive experience of designing tangible digital representations of a better future through creating computing can contribute to empowerment of this disadvantaged population.

References

Benonol, N., & Blau, I. (2016). Can I become smarter? Creative computing and changing Implicit Theories of Intelligence among at-risk youth and normative students. In Y. Eshet-Alkalai, I. Blau, A. Caspi, N. Geri, Y. Kalman, & V. Silber-Varod, (Eds.), *Learning in the Technological Era* (pp. 44-51). Ra'anana, Israel: The Open University of Israel. [in Hebrew].

Bergstrom, I., & Lotto, R. B. (2015). Code bending: A new creative coding practice. *Leonardo*. MIT Press.

Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development*, *78*(1), 246-263.

Blau, I. & Barzel-Rubin, A. (2013). Assisting learning disabilities and empowering excellence by "clickers" and interactive whiteboards. In *Proceedings of the 15th Biennial EARLI2013 Conference for Research in Learning and Instruction.* TUM School of Education, Technical University Munich, Germany.

Blau, I., & Peled, Y. (2015). How do one-to-one technologies impact learning and visualizing-verbalizing styles of school students? In *Proceedings of the 16th European Conference for Research on Learning and Instruction - EARLI 2015: Towards a Reflective Society: Synergies between Learning, Teaching and Research*. Limassol, Cyprus.

Blau, I., & Shamir-Inbal, T. (2016). Digital competences and long-term ICT integration in school culture: The perspective of elementary school leaders. *Education and Information Technologies*, 1-19. DOI: 10.1007/s10639-015-9456-7.

Blau, I., Zuckerman, O., & Monroy-Hernández, A. (2009). Children participation in media content creation community: Israelis learners in Scratch programming environment. In Y. Eshet-Alkalai, A. Caspi, S. Eden, N. Geri, & Y. Yair (Eds.), *Learning in the technological era* (pp.65-72). Ra'anana, Israel: The Open University of Israel.

Brennan, K., Chung, M., & Hawson, J. (2011). *Creative computing: A design-based introduction to computational thinking.* MIT Media Lab, USA.

Brennan, K., & Resnick, M. (2012). New frameworks for studying and assessing the development of computational thinking. In *Proceedings of the 2012 annual meeting of the American Educational Research Association,* Vancouver, Canada (pp. 1-25).

Damon, W. (2008). *How young people find their calling in life: The path to purpose*. New York: Simon and Schuster.

Dishion, T. J., Véronneau, M. H., & Myers, M. W. (2010). Cascading peer dynamics underlying the progression from problem behavior to violence in early to late adolescence. *Development and Psychopathology*, *22*(03), 603-619.

Dweck, C. S. (1999). *Self-theories: Their role in motivation, personality and development.* Philadelphia: Taylor & Francis/Psychology Press.

Dweck, C. S. (2008). Can personality be changed? The role of beliefs in personality and change. *Current Directions in Psychological Science, 17,* 391–394.

Dweck, C. S., & Henderson, V. L. (1988). *Theories of intelligence: Background and measures*. Unpublished manuscript.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95,* 256–273.

Dweck, C. S., & Master, A. (2008). Self-theories motivate self-regulated learning. In D. H. Schunk, & B. J. Zimmerman (Eds.), *Motivation and self-regulated learning: Theory, research, and applications* (pp. 31–51). New York, NY: Lawrence Erlbaum Associates.

Eshet-Alkalai, Y. (2012). Thinking in the digital era: A revised model for digital literacy. *Issues in Informing Science and Information Technology*, *9*, 267-276.

Flanagan, S. (2015). Introduce programming in a fun, creative way. *TechDirections, 74*(6), 18. Retrieved May 1, 2016 from http://scratched.gse.harvard.edu/sites/default/files/tech_directions_article_-_january_2015.pdf

Grover, S., & Pea, R. (2013). Computational thinking in K–12: A review of the state of the field. *Educational Researcher*, *42*(1), 38-43.

Heng, M. A., & Blau, I. (2016). Finding purpose: What Singaporean and Israeli adolescents are telling us. In *Proceedings of the 2016 APA Annual Convention*. Denver, Colorado, USA.

Kafai, Y. B. (2016). From computational thinking to computational participation in K-12 education. *Communications of the ACM*, *59*(8), 26-27.

Kafai, Y. B., & Burke, Q. (2014). *Mindstorms 2: Children, programming, and computational participation*. Retrieved May 1, 2016 from http://constructionism2014.ifs.tuwien.ac.at/papers/2.6_3-8530.pdf

Kafai, Y. B., & Burke, Q. (2015). Computer programming goes back to school. *Education Week*, 61-65.

Ke, F. (2014). An implementation of design-based learning through creating educational computer games: A case study on mathematics learning during design and computing. *Computers & Education*, *73,* 26-39.

Lye, S. Y., & Koh, J. H. L. (2014). Review on teaching and learning of computational thinking through programing: What is next for K-12? *Computers in Human Behavior, 41*, 51-61.

Mahiri, J. (2011). *Digital tools in urban schools: Mediating a remix of learning*. Ann Arbor: University of Michigan Press.

Mariano, J. M., Going, J., Schrock, K., & Sweeting, K. (2011). Youth purpose and the perception of social supports among African-American girls. *Journal of Youth Studies, 14,* 921-937.

McWhirter, J. J., McWhirter, B. T., McWhirter, A. M., & McWhirter, E. H. (2003). *At-risk youth: A comprehensive response.* Pacific Grove, CA: Brooks/Cole.

Mekamel, L., & Blau, I. (2014). Mentoring social network as assistive technology for students with communication disabilities and intellectual impairments. In *Proceedings of the AECT2014 (Association for Educational Communications and Technology) International Convention on Learning, Design and Technology.* Jacksonville, Florida, US.

Mekamel, L., & Blau, I. (2016). How mentoring social network can become as an assistive technology for students with communication disabilities and students with intellectual impairments? In Y. Eshet-Alkalai, I. Blau, A. Caspi, N. Geri, Y. Kalman, & V. Silber-Varod, (Eds.), *Learning in the technological era* (pp. 156-165). Ra'anana, Israel: The Open University of Israel. [in Hebrew].

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books.

Papert, S. (1996). An exploration in the space of mathematics educations. *International Journal of Computers for Mathematical Learning*, *1*(1), 95-123.

Park, N. (2016). Development of computer education program using LOGO Programming and fractals learning for enhancing creativity: Focus on creative problem-solving. *International Journal of u- and e-Service, Science and Technology, 9*(2), 121-126. Retrieved from http://www.sersc.org/journals/IJUNESST/vol9_no2/13.pdf

Parker, L. L. (Ed.) (2008). *Technology-mediated learning environments for young English learners: Connections in and out of school.* New York: Lawrence Erlbaum Associates.

Peppler, K., & Kafai, Y. (2007). From SuperGoo to Scratch: Exploring creative digital media production in informal learning. *Learning, Media and Technology 32*(2), 149–166.

Resnick, G., & Burt, M. R. (1996). Youth at risk: Definitions and implications for service delivery. *American Journal of Orthopsychiatry*, *66*(2), 172-188.

Robins, R. W., & Pals, J. L. (2002). Implicit self-theories in the academic domain: Implications for goal orientation, attributions, affect, and self-esteem change. *Self and Identity, 1,* 313–336.

Shamir-Inbal, T., & Blau, I. (2014). How the implementation of tablet computers impacts learning and pedagogy and promotes "digital wisdom" of students and teachers in the elementary school? In *Proceedings of the 8th International Technology, Education and Development Conference - INTED2014* (p. 3438). Valencia, Spain.

Shamir-Inbal, T., & Blau, I. (2016a). Developing digital wisdom by students and teachers: The impact of integrating tablet computers on learning and pedagogy in an elementary school. *Journal of Educational Computing Research*. doi: 10.1177/0735633116649375.

Shamir-Inbal, T., & Blau, I. (2016b). Digital literacy skills and the challenge of collaborative culture in higher education: From individual psychological ownership to co-ownership. In *Proceedings of the 8th annual International Conference on Education and New Learning Technologies-EDULEARN2016*. Barcelona, Spain.

Sharples, M., Adams, A., Alozie, N., Ferguson, R., FitzGerald, E., Gaved, M., . . . Yarnall, L. (2015). *Innovating pedagogy.* The Open University of England, Innovation Report, N4. Retrieved May 1, 2016 from http://www.open.ac.uk/blogs/innovating/?p=3

Snyder, H. N. (2004). An empirical portrait of the youth reentry population. *Youth Violence and Juvenile Justice, 2*, 39-55.

Watkins, S. C. (2009). *The young and the digital: What the migration to social-network sites, games, and anytime, anywhere media means for our future.* Boston: Beacon Press.

Wing, J. M. (2006). Computational thinking. *Communications of the ACM*, *49*(3), 33-35.

Yang, H., & Zhang, L. (2016). Promoting creative computing: Origin, scope, research and applications. *Digital Communications and Networks*. doi:10.1016/j.dcan.2016.02.001

Yeager, D. S., Trzesniewski, K. H., & Dweck, C. S. (2013). An implicit theories of personality intervention reduces adolescent aggression in response to victimization and exclusion. *Child Development*, *84*(3), 970–988.

Zuckerman, O., Blau, I., & Monroy-Hernández, A. (2009). Children's participation patterns in online communities: An analysis of Israeli learners in the Scratch online community. *Interdisciplinary Journal of E-Learning and Learning Objects, 5,* 263-274. Retrieved from http://www.informingscience.org/Publications/77

Biographies

Ina Blau is a Senior Lecturer in the Department of Education and Psychology, at The Open University of Israel. She has a PhD. in E-Learning and Cyber-Psychology. In 2011-2014 she was a lecturer in the Department of Information & Knowledge Management, Graduate School of Management, University of Haifa, and in 2015 - a Visiting Scholar at the National Institute of Education (NIE) and Learning Sciences Lab, Nanyang Technological University (NTU), Singapore. Dr. Blau has diverse experience in teaching, educational management, and teacher's professional development related to technology-enhanced teaching and e-learning. Her research interests and publications focus on social aspects of e-communication and e-leadership; integration of innovative technologies in K-12, academia and organizations; mobile learning and interaction; digital literacy skills; the effect of "productive failure" experience on the development of creativity; psychological ownership in e-collaboration and online privacy in social networking. She has led large-scale research projects which were supported by research grants from the Israeli Ministry of Education and focused on the phenomenon of digital cheating and plagiarism from the perspective of Israeli pupils, teachers and parents, and on processes and outcomes of one-to-one computing in schools.

Nurit Benolol is a lecturer at Beit Berl College in Kfar Saba, Israel. She completed her Bachelor's degree in Education at Beit Berl as well as her teaching certificate, with a focus on the social sciences. She completed her Master's degree in Educational Consulting at Bar Ilan University, writing her thesis on the influence of therapeutic intervention through sport under the supervision of Dr. Shlomo Romi. She proceeded to complete her doctorate at Bar Ilan, writing her thesis on the topic of "The role of personal and social capital in the adjustment of youth at risk, in the transition to young adolescence" under the supervision of Prof. Shmuel Shulman. She currently teaches in the Department of Criminology at Beit Berl College. Dr. Benolol has rich professional experience and serves as an Educational Consultant in the educational system for the last 20 years. In her private practice she uses cognitive behavioral therapy to help children and youth with functional difficulties.

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Ungar, O. A., & Baruch, A. F. (2016). Perceptions of teacher educators regarding ICT implementation. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 279-296. Retrieved from http://www.informingscience.org/Publications/3606

Perceptions of Teacher Educators Regarding ICT Implementation in Israeli Colleges of Education

Orit Avidov Ungar
Achva Academic College, and Open University
Israel

oritav65@gmail.com

Alona Forkosh Baruch
Tel-Aviv University, and Levinsky College of Education
Israel

alonabar@post.tau.ac.il

Abstract

ICT (Information and Communication Technologies) in teacher education poses new challenges to faculty and students. This study was carried out to examine factors facilitating and hindering ICT implementation in teacher education institutes in Israel. Findings from our study, administered at two points in time, revealed that providing technological-pedagogical support to teacher educators and their perceptions and beliefs regarding ICT usage were consistent with being either facilitating or hindering factors in the integration process in colleges of education. Professional development of teacher educators in ICT skills and guidance in applying advanced technologies are additional facilitating factors. Resources, mainly time and infrastructure, were mostly a hindering factor with adverse influence on ICT integration. Three levels of successful ICT integration indicated successful implementation: teacher educators' level, students in their practice, and the organization level in terms of policy.

Keywords: teacher educators, ICT Implementation, facilitating factors, hindering factors, colleges of education

Introduction

Teacher training in Israel and worldwide has undergone major change in the last few decades, in an attempt to increase its professional standards and prestige – a priority in many countries; as a result there is a growing trend to recruit better preservice candidates (Darling-Hammond, 2006; Mumtaz, 2000; Toledo, 2005). The education system, including teacher education programs, is required to improve itself by becoming more relevant for the information era, by adopting technological innovation. This may enable better reaction to global as well as local economic and social changes, in an attempt to raise students' achievements (UNESCO, 2009). Contemporary teacher training enforces colleges of education to adapt to these needs and to examine the means by which preservice teachers are exposed to ICT (Information and Communication Technologies) implementation processes during their training (Kay, 2006). In this process, teacher educators become a pillar in lead-

Editor: Janice Whatley

An earlier, shorter version of this paper was presented at the Chais conference 2016, in Raanana, Israel, and included in Y. Eshet-Alkalai, I. Blau, A. Caspi, N. Geri, Y. Kalman, & V. Silber-Varod (Eds.), *Proceedings of the 11th Chais Conference for the Study of Innovation and Learning Technologies 2016: Learning in the Technological Era*. Raanana: The Open University of Israel.

ing the expected change in training (Loughran, 2014; Thomas, Herring, Redmond, & Smaldino, 2013). Lecturers and pedagogical advisors, comprising the teacher educating faculty, are expected to serve as models for preservice teachers in leading change in education and in reaching the highest standards (Loughran, 2014; Thomas et al., 2013); these standards apply to ICT implementation processes as a lever for developing innovation and entrepreneurship in education, among other educational criteria (Ertmer & Ottenbreit-Leftwich, 2010; Pope, Hare & Howard, 2005). Teacher educators may have critical influence on knowledge, skills, beliefs, and perceptions of preservice teachers, which may in turn have bearing on their craft as teachers (Koster, Brekelmans, korthagen & Wubbels, 2005).

In the Israeli education system, as a result of global trends as well as local initiatives, a reform has been declared for implementing ICT in schools as part of a national initiative to adapt the education system to 21st century requirements in terms of skills, knowledge, and competencies. In 2012 this initiative was broadened to include colleges of education by publishing a call to action by the Ministry of Education. The goals of this study were to examine factors aiding and preventing ICT implementation and what might be considered successful ICT implementation in teacher education, as perceived by teacher educators in colleges of education, and how these perceptions change over the timespan of the computerization initiative.

Literature

ICT Implementation in the Education System

One of the explanations of the notion that change is not implemented successfully in the culture of an organization is that “blocking forces” create a barrier in leading reforms and implementing change (Lewin, 1951). These obstructions that block technology diffusion in the education system focus on two major aspects: organizational-management factors that reflect the need for pedagogical and technological adaptations required for ICT implementation, and factors that reflect personal aspects, e.g., teachers’ perceptions and beliefs regarding ICT implementation in their own teaching (Hultman, 1995; Sung & Gibson, 2015; Teo, 2011). Also, there is a vague definition of what would be considered success in ICT implementation in education, causing tension and questions regarding the optimal implementation processes altogether (Kaniuka, 2012). Promoting as well as obstructing forces are influential on the ability to create processes of change and innovation within the education system (Cook, Holley, & Andrew, 2007; Liu, 2011), as this is an ongoing and lengthy process (Kotter & Cohen, 2012). Some studies define a 5-year period for implementing technology in an organization (Cummings & Worley, 2015). This time span is vital for creating a process of change, in which the organization is exposed to an innovation and to its implementation process, then a diffusion process is carried out, in which novelties are disseminated and diffused into the organization. The organization in turn adopts new traits and categories among its members (Rogers, 1995). These are all necessary for the success of the implementation process and influence, in turn, the facilitating and hindering factors of change, as well as the organization’s members’ perceptions regarding this change (Surry, Ensminger, & Jones, 2002).

Teacher Educators’ Role in ICT Implementation in Colleges of Education

Teacher educators have a fundamental role in training preservice teachers for teaching in the information era, in utilizing ICT effectively, and in awareness of the facilitating and hindering factors related to this process (Drent & Meelissen, 2008; Gomez, Sherin, Griesdorn, & Finn, 2008). Teacher educators may serve as meaningful role models for ICT-based teaching; by doing this, they are able to design teaching patterns of preservice teachers and better prepare them for their future profession (Brzycki & Dudt, 2005; Pope et al., 2005). Exposing these preservice teachers to novel pedagogical modes of teaching and learning, and experiencing them first-hand in terms of the added value of ICT for teaching and learning, may enhance their ability to implement these patterns in class (Goldstein et al., 2011, 2012). Teacher educators can influence knowledge, skills, and professional capabilities of their students, as well as their beliefs, attitudes and perceptions (Koster et al., 2005). Teachers attaining "digital wisdom" should be technologically independent, acquire technological-pedagogical knowledge, base their application of ICT on practical experience, and combine technology in education wisely (Siemens & Tittenberger, 2009); the same is applicable to teacher educators (Krumsvik, 2014).

Educational reforms are popular among policymakers and are relatively frequent in the current era of change and innovation. This creates an identity crisis among teachers, which in turn influences their sense of self-efficacy, their satisfaction, and their commitment to the teaching profession (Day, Elliot, & Kington, 2005). The larger the gap between teachers' perceptions, beliefs, and personal attitudes and the systemic perceptions regarding the meaning of being a professional teacher (a result of changes in the curricula as well as the educational milieu in general), the greater the friction that creates tension within the components of teachers' as well as preservice teachers' professional identity (Goktas, Yildirim, & Yildirim, 2009; Merseth, Sommer, & Dickstein, 2008). There is great importance to ensuring a dialog between change and new curricula (reflecting new policy) and teachers' professional perceptions developing within teacher education programs. Teacher educators have a major role in this dialog (Chong, Low, & Goh, 2011; Lamote & Engels, 2010).

The Israeli National Program for the Computerization of Academic Colleges of Education

Since Glister's (1997) original definition that "digital literacy is about mastering ideas not keystrokes," which paved the shift from traditional basic technical skills training, there has been a plethora of proposed models and frameworks for digital literacy/literacies, changing and adapting as new types of technology, media, and information sources arise, whilst also trying to anticipate future employment trends (All Aboard – Digital Skills in Higher Education, 2015, p. 18). Accordingly, the ministry of education in Israel in the past four years, starting in 2012, initiated a reform titled "The National Program for Adapting Education to the 21st Century, or in its more popular title, "The Israeli national ICT program". The program promotes ICT implementation in schools country-wide, thereby promoting higher order thinking skills, creativity, collaborative skills and additional skills needed for 21st century citizens (Mioduser, Nachmias, & Forkosh-Baruch, 2008). The new literacies serve as a basis for studies worldwide on ICT implementation in education and are also used for systemic studies on a national level as well, the in K12 (Kindergarten to 12 grade) system as well as in teacher training. The Israeli education system has based its computerization programs on such models. The development of Information and Communication Technologies (ICT) and the rapid growth of the Internet fundamentally influenced teacher preservice training in Israel as well. The Israeli Computerization Program has evolved from instrumental use of ICT in teaching to a genuine shift in pedagogical paradigms, massively influencing teaching and learning (Mandinach, 2005).

National Computerization Program – Stage 1

The National Computerization Program had begun its course as far back as 1994, running until the year 1998, following a National Report (Harari 1992; Ministry of Education Israel [MOE], 2003). The main purpose of this initial stage was to supply schools with infrastructure, as well as to train teachers in basic ICT implementation. In this stage, teacher education colleges training pre-service teachers were not included in the National Computerization Program.

National Computerization Program – Stage 2

Schools in the education system participated in a 3-year stage of the National Computerization Program, beginning in 1998, which focused on implementing ICT in all subject matters. In this stage the policy emphasized the potential of ICT for teaching and learning, and the main goal of this stage was to empower and possibly implement novel pedagogy. Teacher education colleges training pre-service teachers were not included in this stage either.

National Computerization Program – Stage 3

As a result of a 3-year study focusing on the integration process of ICT in teacher education in Israel between the years 1993-2008, and in the light of theories of innovation and organizational change (e.g., Finley & Hartman, 2004; Guri-Rosenblit, 2002; Hall & Hord, 1987; Surry, Ensminger, & Haab, 2005), teacher pre-service education was included in the third stage of this national initiative since 2011. The program for pre-service teachers was entitled: "The National Program for Adapting Teacher Education Colleges to the 21st Century", i.e., within 3 years all colleges were granted a sum of approximately $150,000 each (altogether a sum of approximately $3,750,000 for executing ICT-based educational initiatives for pre-service training, as well as for faculty training within each college. The initiative was funded by the Administration of Science and Technology as well as the Department for Teacher Training, both divisions in the Israeli Ministry of Education (MOE) (MOE Israel, 2011).

The Israeli Ministry of Education (Rimon, 2010) enforced this national program for adapting the academic colleges of education to 21st century education as part of a holistic view of the education system in general and teacher professional development (TPD) in particular. The goal of this stage was to create a continuum of professional development, beginning with pre-service and creating ongoing in-service TPD. This is in line with the notion of lifelong learning (Lim, Chai, & Churchill, 2011; Teo, 2010). According to this plan, colleges of education received funding for (a) upgrading their infrastructure, and (b) professional training of their faculty, dependent on the submission of institutional computerization programs for implementation of Information and Communication Technologies (ICT) in their training programs.

While the focus of the initial program was to install computers in classrooms and train teachers on a large-scale, the focus of the current program is manifold: (a) instilling 21st century skills, (b) empowering teachers and teaching in schools, (c) adapting education to diverse students, (d) providing real-time feedback, (e) arousing interest among students, and (f) facilitating communication between teachers and other stakeholders within the education system. The main goal is to lead novel pedagogy in the education system, ICT having a major role in this initiative (MOE Israel, 2011). The Israeli Ministry of Education (MOE Israel, 2012) decided that colleges of education that are training future teachers will implement ICT in their teaching of teacher educators and will assist preservice teachers to implement ICT in their practice in schools during their training as future teachers in the education system.

A year after submitting the computerization programs, in 2012, nine colleges of education received the required funding on a competitive basis (according to the quality of the programs they submitted), and began to implement their three-year computerization plan. This process was accompanied by research, led by a research group including representatives from these colleges as well as from the Israeli MOE's Department for Teacher Training and Professional Development.

Respectively, the goal of this study is to examine what might be considered successful ICT implementation in teacher education, as perceived by teacher educators in colleges of education, and how these perceptions changed over the time span of the computerization program. In this study, we followed-up how these perceptions have changed within the boundaries of the program, in two time-periods about two years apart, i.e., at the beginning of the ICT implementation process and towards the end of the program. Research questions were, consequently, the following: What were the facilitating factors for ICT implementation in teacher training? What were the hindering factors for ICT implementation in teacher training? What would be considered effective ICT implementation in teacher training? Whether there are differences in these questions identified in two points in time: at the beginning of the initiative and towards the end of the 3-year initiative?

Method

Research Method

This study is part of a large-scale collaborative study under the Mofet institute, a consortium of Israeli colleges of education which specializes in research, curriculum, and program development for teacher educators. The focus of the study as a whole is to gain insights regarding successes and challenges in the implementation process of the National Program for Adapting the Colleges of Education to the 21st Century. It was also aimed at supplying policymakers and stakeholders with information for creating a theoretical as well as practical framework for teacher training in the 21st century in Israel.

In the current study, a qualitative research method was utilized, enabling exposure of unique meanings, characterization of processes and variables, and interpretation of the phenomena at the heart of this study. The study was conducted over two points in time, in which we compared the same items (Fraley & Hudson, 2014; Kelly, Lesh, & Baek, 2014), and teacher educators responded to an identical questionnaire in two points in time across a 3-year initiative: at its beginning and towards the end of the program (see: Hanus & Fox, 2015).

Although the study was qualitative in nature, in order to compare differences over the period of the study a quantitative analysis of frequencies was conducted according to categories, with relation to the three research questions, e.g., facilitating factors, hindering factors, and measures of successful ICT implementation in colleges of education.

Research Context and Population

Respondents were teacher educators that serve as faculty members in academic colleges of education in Israel. Colleges that participated in the study included institutes that were awarded a budget based on a call to action by the Israeli MOE for implementing ICT in the training curricula. Hence, data was collected from 8 colleges of education (of 21 altogether), comprising some of the largest institutes for teacher training in Israel: 2 colleges from northern Israel, 3 from the center and 3 from the southern part of the country. These colleges were the first to implement ICT in a systemic manner.

The population included respondents of the questionnaire during two independent point in time, i.e., participants were not the same respondents in the year 2013 (N=615, which comprised 22.8% of the teacher educators in these colleges) and in the year 2015 (N=586, which comprised 21.7% of the teacher educators in these colleges); hence we could not pair the responses and initially that was not our intention; rather, we aimed to identify general themes regarding the research questions we presented and possible differences in trends between the two point in time.

Research Tools

The tool used in this study was a questionnaire developed by a network of fellow-researchers from Israeli colleges of education (Goldstein et al., 2011, 2012). The questionnaire was developed for teacher educators and distributed in 8 colleges of education nationwide. It examined the perceptions and attitudes of teacher educators in colleges of education regarding ICT implementation in their teaching as well as the ways they use ICT and the intensity and scope of its usage.

The questionnaire included a quantitative component and a qualitative component. In this article we refer to the qualitative component, comprising of three open-ended questions: (a) What encourages faculty to implement ICT in their teaching in the college? (b) What hinders ICT implementation of faculty in their teaching in education? (c) What would be considered a success in ICT implementation in the college? Data was collected in two points in time: the first in 2013 at the beginning of the national initiative, and the second in 2015, towards the end of the initiative.

The range of teacher educators who responded to the questionnaires in 2013 and 2015 was similar in terms of number of respondents as well as percent. Altogether, 615 teacher educators (22.8% of total amount of teacher educators in these colleges) responded to the 2013 questionnaire, and 586 teacher educators (21.7% of total amount of teacher educators in these colleges) responded to the 2015 questionnaire. The open-ended questionnaires reported in this study were addressed by only some of the participants. Table 1 details the scope of responses for each of the open-ended questions in each of the two administration points in time in terms of number of respondents and percent of the total respondents of the questionnaires.

Table 1: Percent of participants' responses to the open-ended questions of the total sample

Q no.	Questions	No. of respondents	% of respondent	No. of respondents	% of respondents
		2013 (N=615)		2015 (N=586)	
Q 11	What would encourage you to implement ICT in your teaching in the college?	383	62%	306	52%
Q 12	What would hinder your ICT implementation in your teaching in the college?	433	74%	294	50%
Q 13	What would be considered a success in effective ICT implementation in teaching in the college?	360	58%	226	39%

There were more responses to all open-ended questions in the first administration of the questionnaire in the year 2013. The lowest percent of responses was to the question regarding what would be considered successful ICT implementation in the college. This may have been a more complex notion compared to the first two questions referring to facilitating and hindering factors of ICT implementation in colleges of education, which may have been easier to address.

Data Analysis

Analysis of the open-ended responses included the following stages. (a) Responses were classified according to the three research questions: statements referring to facilitating factors of ICT implementation in the college of education, statements referring to hindering factors of ICT implementation in the college, and statements referring to successes in ICT implementation in the college. (b) Respondents' statements were classified according to themes or characteristics, e.g., lack of time, successful peer support. If a response included more than one characteristic, it was divided and assigned to more than one theme, e.g., "there is a need for teacher educators to collaborate and to learn together". (c) Similar segments of statements were collected and assigned to one major category. Similarly, an ensemble of categories was created, exhibiting the main themes found in the respondents statements, e.g., the two statements "to receive ICT tools" and "to influence teacher education" were assigned to the category "professional development". (d) The segment-count within each category was according to types (vs. tokens). Two researchers examined the statements and assigned them (or their segments) to categories. Segments under dispute were discussed until a joint decision was reached regarding its classification. (e) Quantitative analysis of frequencies was conducted according to categories, with relation to the three research questions, e.g., facilitating factors, hindering factors, and measures of successful ICT implementation in colleges of education. This was of value for comparing responses from the two points in time at which the questionnaire was administered. Analysis was conducted for each of the time slots separately; results herewith will present a quantitative comparison of categories between responses in 2013 and 2015.

Results

Results of the study will be presented in the following 3 sub-sections, according to the three research questions: factors encouraging ICT implementation in colleges of education, factors hindering ICT implementation in these colleges, and perception of success in implementation in these colleges from the viewpoint of teacher educators. We include qualitative data in order to present the nature of the category, and quantitative data – to compare the two points in time; this is achieved by descriptive statistics that portray the strength of each category.

Factors Encouraging the Implementation of ICT among Teacher Educators in Colleges of Education

Altogether, 20 categories were found to be encouraging ICT implementation among teacher educators in colleges of education. When analyzing results from 2013 and 2015, additional meaningful categories were found in the later survey, as well as categories that were more salient. Technological-pedagogical support to teacher educators was found to be the most meaningful category in teacher educators' ICT implementation in their teaching, even more in 2105 when compared to 2013 (39.5% and 31% respectively). Three categories that were not mentioned in 2013 as encouraging factors, but were mentioned in the latter survey of 2015, were the need for demonstrating effective ICT implementation, adaptation of technology for systemic needs, and students' knowledge and motivation for implementing ICT in their teaching and learning.

Findings show that the importance of some categories that are considered as facilitators of ICT in teaching had dropped as perceived by teacher educators in the second survey in 2015 compared to the first survey in 2013. These include professional development, e.g., encompassing instruction, professional mentoring and exposure to workshops – all of which were considered more encouraging in the 2013 survey compared to the 2015 survey (24% and 15.7% respectively). Similarly, adequate rewarding for teacher educators for ICT implementation in their teaching (17% in 2013 vs. 10.5% in 2015), availability and accessibility of technological equipment in the college (15% in 2013 vs. 10.5% in 2015), as well as perceptions and beliefs of teacher educators regarding ICT implementation in teaching (19% in 2013 vs. 15.4% in 2015) were all more frequently mentioned in the first survey. The three new categories mentioned in 2015 as facilitators of ICT implementation within colleges of education were time for adapting to change, modeling, and adaptation of technology to systemic requirements. Table 2 presents a comparison of all facilitating factors of ICT implementation in 2013 and in 2015, according to content analysis of teacher educators' responses, as well as some exemplary quotes.

Table 2: distribution of responses regarding encouragements to implement ICT in teacher educators' teaching 2013 and 2015

		2013		2015	
No.	**Categories**	**no. of responses**	**% of responses**	**no. of responses**	**% of responses**
1	Technological-pedagogical support to teacher educators	123	%31	121	%39.5
	"We get workshops on implementing additional novel technological means, beyond the traditional workshops for introducing usages of Moodle."				
2	ICT professional development workshops, instruction and ongoing professional guidance	93	%24	48	%15.7
	"The instructions published for using the various options in Moodle really help me. And when in need, I use the technical help that the college offers."				
3	ICT attitudes and beliefs	72	%19	47	%15.4
	"I believe that this is the change needed in the college, we have a responsibility for training students."				
4	Offering incentives	65	%17	32	%10.5
	"In the college we were greatly appreciated for our investment in the implementation of ICT. We even received hours for it."				
5	Accessibility and availability of equipment for teacher educators and students	59	%15	32	%10.5
6	Allocation of time	38	%10	32	%10.5
7	College physical conditions and infrastructure	25	%6.5	31	%10
8	Supportive and mandatory policy	21	%5.5	23	%7.5
9	Students implementing ICT	20	%5	22	%7
10	Collaboration between teacher educators	15	%4	20	%6.5
11	Promoting efficiency at work	12	%3	17	%5.6
12	Challenge, innovation, motivation	9	%2	15	%4.9
13	Experience and practice in ICT implementation in teaching	9	%2	14	%4.6
14	Don't know what encourages	5	%1	13	%4.3
15	Support and encouragement of the head of department	4	%1	11	%3.6
16	Physical conditions and infrastructure in schools and kindergartens	3	%0.8	7	%2.3
17	Time to adapt to change	2	%0.5	3	%1
18	Demonstration/modeling	0	%0	2	%6.5
19	Adapting technology to the system	0	%0	2	%4.9
20	Students' knowledge and motivation	0	%0	1	%4.6

Factors Hindering the Implementation of ICT among Teacher Educators in Colleges of Education

Analysis of data from the two surveys in 2013 and 2015 shows that almost all categories mentioned by teacher educators in 2013 as hindering ICT implementation were perceived more significant in 2015, as shown by their increased frequency of being mentioned. However, the two categories perceived as the most significant in hindering ICT implementation among teacher educators in their teaching were similarly important in both 2013 and 2015: i.e., time resources, technological infrastructure and rewarding; and ICT knowledge, skills and competencies of teacher educators. Additional factors hindering ICT implementation in teaching as perceived by teacher educators are infrastructure and technological aspects in the college, (20% in 2013 and 15% in 2015), and beliefs and perceptions of teacher educators towards ICT (12% in 2013 and 19% in 2015). College policy was mentioned to a lesser extent as a hindering category regarding ICT implementation (6% in 2013 and 8% in 2015). The two categories found in 2015 but not in 2013 were adaptation of ICT to system requirements and aspects related to the process itself. Factors hindering ICT implementation in teacher educators' teaching and a comparison between the two periods of survey administration (including participants' quotes) are presented in Table 3, as well as some exemplary quotes.

Table 3: distribution of responses regarding impediments to implementing ICT in teacher educators' teaching 2013 and 2015

		2013		2015	
No.	**Categories**	**no. of responses**	**% of responses**	**no. of responses**	**% of responses**
1	Resources, especially time resources	135	%30	93	%31.6
	"The enormous time investment required for preparing meaningful ICT-based lessons."				
2	Knowledge, skills, instruction	97	%21	65	%22
	"Lack of knowledge and lack of understanding of the possibilities before me."				
3	Infrastructure and technological aspects	68	%15	58	%20
	"Lack of classes for ICT-based instruction", "Shortage of laptops for students."				
4	Perceptions and beliefs of teacher educators regarding ICT and its implementation	55	%12	56	%19
	"Some of the teacher educators, and myself a bit as well… we don't really believe that you can implement ICT in teaching in a way that changes instruction and makes it better."				
5	No hindering factors	31	%7	43	%15
6	Institute policy regarding ICT implementation	29	%6	23	%8
7	Adequate rewarding	24	%5	15	%5
8	Competencies and readiness of students	13	%3	12	%4
9	Adapting technology systemic needs	0	%0	10	%3
10	Aspects connected to the process itself	0	%0	9	%3

Perceived Indicators of Success in the Implementation of ICT among Teacher Educators in Colleges of Education

When comparing the data of 2013 and 2015, results also show that with regards to success in implementing ICT, all categories mentioned in 2013 were perceived as more significant it 2015, some exhibiting vast differences. One exceptional category was ICT implementation in academic courses, perceived as an equally central and significant measure for success in both surveys. Contrary to this, some categories were found as more frequent in perception of success in 2015 compared to 2013: students implementing ICT in their practice (29% in 2015 vs. 15% in 2013); resources, infrastructure and budgeting (27% in 2015 vs. 10% in 2013); perceiving technological change as a means for achieving goals (23% in 2015 vs. 9% in 2013); investment vs. output tradeoff (17% in 2015 vs. 9% in 2013); supportive college policy (16% in 2015 vs. 6% in 2013); and teacher educators' motivation (10% in 2015 vs. 4% in 2013). ICT implementation in schools was perceived as marginal in both surveys.

The categories found among teacher educators based on their responses to the question of what would be considered success in ICT implementation in colleges of education, when comparing results from content analysis of responses in 2013 and 2015 are presented in Table 4, as well as some exemplary quotes.

Table 4: distribution of responses regarding what would be considered success in implementing ICT in teacher educators' teaching

		2013		2015	
No.	**Categories**	**no. of responses**	**% of responses**	**no. of responses**	**% of responses**
1	Teacher educators implementing ICT	146	%38	95	%40
	"Success in ICT [implementation] is success in maximal utilization of technology for application of various pedagogical ideas suitable for teaching goals of lecturers and for the content they teach. Variation in teaching methods and teaching environments, including encouragement of mobile learning, collaborative learning, distance learning, project based learning – can all mark success in implementing ICT in the college."				
2	Students implementing ICT in their practice	55	%15	64	%29
	"The success is the moment graduate students begin to use ICT wisely and without fear."				
3	Resources, budget, infrastructure	35	%10	61	%27
	"Making technology accessible for lecturers and students, availability of massive support."				
4	Technological change as means for achieving goals	32	%9	50	%23
	"That lecturers will want to implement ICT out of their own choice and not as a necessity", "A process that takes time, everyone joins the process in the place and measures suitable for them".				
5	Investment vs. output tradeoff	34	%9	39	%17
6	Supportive college policy	21	%6	37	%16
7	Negative attitudes	24	%6	37	%16
8	Teacher educators' motivation	15	%4	22	%10
9	ICT implementation in schools	15	%4	8	%4

Examination of teacher educators' responses to the question of what would be considered success in ICT implementation in colleges of education found 3 major measures: success measures related to students, those related to teacher educators, and those referring to the college organization and its policy. In the first survey in 2013, 377 statements were counted regarding measures of success in ICT implementation in colleges, while in 2015 391 statements were counted. Table 5 details these statements according to the 3 levels.

Table 5: Quantification of measures of success according to 3 levels of ICT implementation: student, teacher educator and college level – a comparison between 2013 and 2015

	2013		2015	
Level	No. statements	% statements	No. statements	% statements
Student level	72	19%	76	19%
Teacher educator level	249	66%	228	58%
Organization level (college	56	15%	87	22%

It seems that the perceived importance of organizational factors increased with regards to measures of successful ICT implementation of ICT in colleges of education. Hence, while there are similarities between the two points in time regarding facilitating as well as hindering factors of ICT implementation in these colleges, there are differences and growing tendencies exhibited by the scopes of some of the major categories, indicating a trend and shift from technology per se to techno-pedagogical concerns.

Discussion

ICT implementation in education in general focuses on its usage as a means of empowering teaching and learning, thereby achieving educational goals successfully and more effectively; hence, teacher education (i.e., preparing preservice teachers for teaching in an ICT-saturated era) is more challenging nowadays than in the pre-digital era. Teacher educators, therefore, are expected and encouraged to use ICT for enhancing the learning process of their preservice students as well as their self-efficacy in utilizing ICT, thereby modelling best practices of ICT implementation in schools (Drent & Meelissen, 2008; Scherer, Siddiq & Teo, 2015). This is portrayed in our data, and one of the indicators of success that had grown from the year 2013 to 2015 was students implementing ICT in their practice. This coincides with the now model of teacher training in the Israeli education system that encourages a bidirectional training method: pre-service teachers being trained by mentor teachers, but also contributing to their knowledge and skills (Ministry of Education, 2015).

Being a teacher educator entails the notion of professional development; however, the emphasis nowadays is not only on how to become, but also how to learn as a teacher educator (Martin, 2015; Mckeon & Harrison, 2011). Professional development of teacher educators and its systematic research is a result of the growing interest on what it means to professionally develop as a teacher educator (Loughran, 2014). Indeed, the meaning of success in terms of ICT implementation from teacher educators' point of view according to our study is its incorporation in academic courses, i.e., faculty see themselves as models for their students when teaching pre-service teachers, thereby promoting their confidence and understanding of the benefits of ICT for teaching (Teclehaimanot, Mentzer, & Hickman, 2011).

The Israeli Computerization Program in teacher education was a result of a top-down approach to change; however, teacher educators experienced this program and its implementation within the scope between professional development and professional learning for teachers (Hardy, 2010). Our study emphasizes the need to focus on these two major aspects in teacher educators' professional development: on one hand, learning about pedagogy and learning outcomes as a major driver for growth (Avalos, 2011), and on the other hand, perceiving technology as a fundamental component for achieving this goal in the information era. This combination of technological knowledge and pedagogical knowledge – technological-pedagogical support to teacher educators – was mentioned in our study as a major facilitating factor for ICT implementation in teacher training by teacher educators.

Among facilitating factors, the one mentioned excessively was technical support, as in several previous studies; a wide literature review supports this finding (Buabeng-Andoh, 2012). Moreover, all studies conducted since the systemic implementation of ICT in education in countries worldwide have shown the need for technical support as a prerequisite for successful pedagogical achievements as a result of utilizing ICT (Plomp, Anderson, Law, & Quale, 2009). The three additional factors – modeling of efficient ICT implementation in teaching, adaptation of technology to systemic needs, and knowledge and motivation of students to implement ICT in teaching and learning processes – are all of greater importance in the second survey. Literature regarding technology transfer identifies sixteen variables affecting this process; a latest survey identifies furthermore four key factors in knowledge and technology transfer: communication, i.e., the ability of a medium to convey task-relevant information and media; distance, i.e., proximity of technology; equivocality, i.e., concreteness of knowledge and technology; and motivation, i.e., the incentives for technology transfer activities (Sung & Gibson, 2015). Hence, there is need for a systemic viewpoint of teacher education for technology implementation that builds upon modeling. This may encourage a process of teacher educators transferring and communicating knowledge and self-efficacy in technology utilization to students, resulting in best practices for preservice teachers as well as for teacher educators – as portrayed in this study.

Furthermore, professional development was possible due to the technical support provided in the early stages of ICT implementation, which was a major facilitating factor in the 2013 survey. The literature also suggests that in order for change to occur, conditions need to ripen and allow these processes (Ertmer & Ottenbreit-Leftwich, 2010). This includes the technological aspect, referring to availability and extent of technological equipment, as well as availability and quality of support. In the second survey, two years later, the emphasis on pedagogical aspects as facilitating factors indicates growth of teacher educators and a shift that indicates greater importance of ICT-based practice in schools.

The adaptation of technology to novel pedagogical paradigms requires institutional adaptation as well, as our study reflects. The result suggested by the literature is a joint culture and common language in effective implementation of the expected change (Avalos, 2011; Darling-Hammond, 2000; Hinde, 2004). Also, this requires professional development processes that are tailored for the spirit of change (Borko, 2004). Teachers that feel more competent using technology may cope better with the feeling of challenge in its incorporation in teaching and learning (Krumsvik, 2014); moreover, pedagogical-technological knowledge enables better assessment of the quality of implementation (Thomas et al., 2013).

Managing change is an ongoing endeavor requiring a joint systemic effort of teacher education institutes, in addition to teacher-level factors affecting effective implementation of ICT in preparing future teachers; our data is consistent with this classification (Tondeur et al., 2012). Furthermore, our study shows decrease in the importance of personal factors, e.g., perceptions and beliefs regarding ICT implementation of teacher educators in the second survey. This could be a result of the increase in their experience in using technology for training preservice teachers, as well as their growing knowledge in technical issues as a result of ongoing support. These two factors – adequate support and experience in using technology – enable teacher educators to plan their teaching successfully in a way that is beneficial for their preservice students and more focused on their needs as teachers (Scott, 2013).

Hindering factors mentioned in our study were lack of resources, mostly in terms of time, insufficient technological knowledge, skills and competencies, infrastructure deficiencies, and issues regarding institutional policy (e.g., rewarding) – all found in several studies on ICT implementation in education (Black, Smith, & Lamshed, 2009; Govender, 2012; Surry et al., 2002; Voogt, Knezek, Cox, Knezek, & ten Brummelhuis, 2013).

Positive beliefs and perceptions of teacher educators towards ICT and its role in education are dynamic, and its importance has increased in the second survey. The finding according to which professional development, e.g., instruction, professional mentoring, and exposure to workshops, were considered more encouraging in the 2013 survey than in the 2015 survey could be a result of empowerment of teacher educators to an extent that enables participants of this study to rely on their developing abilities and self-efficacy; these have been known as fundamental in adoption of innovation and change altogether (Day & Lindsey, 2009; Fullan, 2001).

What would be considered successful and effective ICT implementation in teacher education may be influenced by the difficulty in defining success. Based on the RIPPLES (Resources, Infrastructure, Policy, People, Learning, Evaluation, Support) model, the tendency to define success in terms of students' techno-pedagogical competencies in utilizing ICT in their practice in the second survey implies that the output must be measured according to direct impact on K12 students in the education system (Surry et al., 2002). Notwithstanding, teacher educators' role is to serve as role models, emphasizing the schools as the target population, e.g., promoting young preservice teachers' self-efficacy and perceived added value of ICT in classroom practices (Lee & Lee, 2014).

In summary, the success of implementing ICT among teacher educators in their teaching preservice teachers includes external as well as internal factors – both comprising facilitating as well as hindering aspects. Perceptions and beliefs play a major role in ICT implementation in preservice training, as well as technological and pedagogical support in skills and competencies (Avidov-Ungar, 2016).

Conclusions and Future Research

Summarizing the findings to the research questions, i.e., factors encouraging or hindering the implementation of ICT among teacher educators in colleges of education and their increase or decrease over the 2 years, our main findings are that technological-pedagogical support encourages ICT implementation as the computerization program advances. However, professional development and rewarding ICT implementation, as well as availability and accessibility of technological equipment and perceptions and beliefs regarding ICT implementation in teaching had decreased. This may possibly be due to the knowledge as well as personal equipment acquired by teacher educators as a new routine. This in turn caused ICT perceptions and beliefs to be a non-issue, i.e., taken for granted as a necessity in teacher training in the information era. Main findings regarding hindering factors were similar in both surveys, i.e., time resources, technological infrastructure and rewarding ICT implementation, and ICT knowledge, skills, and competencies – these still seem to be insufficient. This may indicate the need to consider the new roles of teacher educators in the 21st century as requiring additional efforts and, as a result, the need for these efforts to be acknowledged somehow.

In the light of the importance of technology as a facilitator of growth in teacher education, the findings of our study are vital in understanding the perceptions, attitudes, and practices of teacher educators that involve ICT as a major component. Findings have unveiled the underlying perceptions of teacher educators in colleges of education regarding ICT implementation within the process of preparing future teachers adequately for teaching in the information era.

Since this study was conducted for the first time in Israel with regards to the research questions presented above in colleges of education, it can serve as a basis and a lever for future studies. Fields of studies that may derive from the current study may include the following: (a) Longitudinal examination of initiatives from the teacher, student and organizational level – this may be performed using qualitative research methods; (b) Based on the categories identified in our study – a quantitative survey may be conducted, including additional colleges of education as well as those who participated in the current study; (c) Comparison with international programs for pre-service teacher training for innovative use of ICT – this may be performed as a meta-analysis of current programs worldwide; (d) Comparison between facilitating factors, hindering factors and measures of success of ICT implementation between colleges of education and K12 institutes, from the viewpoints of the teacher educators vs. teachers, pre-service teachers vs. students, and stakeholders.

References

All Aboard – Digital Skills in Higher Education. (2015), Towards a national digital skills framework for Irish higher education: Review and comparison of existing frameworks and models. Retrieved from http://allaboardhe.org/DSFramework2015.pdf

Avidov-Ungar, O. (2016). Understanding teachers' attitude among educational reforms through metaphor. *International Journal of Educational Research. 77*, 117-127.

Avalos, B. (2011). Teacher professional development in teaching and teacher education over ten years, *Teaching and Teacher Education, 27*, 10-20.

Buabeng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development using Information and Communication Technology, 8*(1), 136-155.

Borko, H., (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher Journal, 33*(8), 3-15.

Black, G., Smith, K., & Lamshed, R. (2009). *Hot topic: ICT in pre-service teacher training – strategic ICT advisory service*. Adelaide, Australia: Australian Government Department of Education, Employment and Workplace Relations. Retrieved Aug. 2016 from http://apo.org.au/files/Resource/ict_in_pre-service_teacher_training.pdf

Brzycki, D., & Dudt, K. (2005). Overcoming barriers to technology use in teacher preparation programs. *Journal of Technology and Teacher Education, 13*(4), 619-641.

Chong, S., Low, E. L., & Goh, K. C. (2011). Emerging professional teacher identity of pre-service teachers. *Australian Journal of Teacher Education, 36*(8), 50-64.

Cook, J., Holley, D., & Andrew, D. (2007). A stakeholder approach to implementing e-learning in a university. *British Journal of Educational Technology*, *38*(5), 784-794.

Cummings, T., & Worley, C. (2015). *Organization development and change*. Cengage learning. US: Cengage Learning.

Darling-Hammond, L. (2000). Policy and change: Getting beyond bureaucracy. In A. Hargreaves, A. Liberman, M. Fullen, & D. Hopkins (Eds.), *International handbook of educational change* (pp. 642-667). Kluwer Academic Publishers.

Darling-Hammond, L. (2006). Constructing 21st – century teacher education. *Journal of Teacher Education, 57*(3), 300-314.

Day, C., Elliot, B., & Kington, A. (2005). Reform, standards and teacher identity: Challenges of sustaining commitment. *Teaching and Teacher Education, 21*(5), 563–577.

Day, C., & Lindsey. (2009). The effects of reform: Have teachers really lost their sense of professionalism? *Journal of Educational Change, 10*(2-3), 141-157.

Drent, M., & Meelissen, M. (2008). Which factors obstruct or stimulate teacher educators to use ICT innovatively? *Computers & Education, 51*(1), 187-199.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education, 42*(3), 255-284.

Finley, L., & Hartman, D. (2004). Institutional change and resistance: Teacher preparatory faculty and technology integration. *Journal of Technology and Teacher Education, 12*(3), 319-337.

Fraley, R. C., & Hudson, N. W. (2014). Review of intensive longitudinal methods: An introduction to diary and experience sampling research. *The Journal of Social Psychology, 154*(1), 89-91.

Fullan, M. G. (2001). *The new meaning of educational change* (3rd ed.). New York: Teachers College Press.

Gilster, P. (1997). *Digital literacy*. John Wiley & Sons, Inc. Wiley Computer Publications.

Goktas, Y., Yildirim, S., & Yildirim, Z. (2009). Main barriers and possible enablers of ICTs integration into pre-service teacher education Programs. *Educational Technology & Society, 12*(1), 193–204.

Goldstein, O., Waldman, N., Tesler, B., Forkosh-Baruch, A., Shonfeld, M., Mor, N., Heilweil, I., Zelkovitz., Z., Zidan, W., & Kozminsky, L. (2011). The current state of pre-service teachers training for ICT based teaching in Israel: 2008-2009. *Proceedings of Global TIME: Global Conference on Technology, Innovation, Media & Education* (February, 22-24, 2011), AACE.

Goldstein, O., Waldman, N., Tesler, B., Shonfeld, M., Forkosh-Baruch, A., Zelkovitz., Z., Mor, N., Heilweil, I., Kozminsky, L., & Zidan, W. (2012). Training pre-service teachers for ICT-based teaching and implementation of ICT in colleges of education: state in 2009. *Dapim, 54*, 20-67. [Hebrew]

Gomez, L. M., Sherin, M. G., Griesdorn, J., & Finn, L. (2008). Creating social relationships: The role of technology in preservice teacher preparation. *Journal of Teacher Education, 59*(2), 117-131.

Govender, D. W. (2012). A model to predict educators' attitudes towards technology and thus technology adoption. *Africa Education Review, 9*(3), 548-568.

Guri-Rosenblit, S. (2002). A top-down strategy to enhance information technologies into Israeli higher education. *International Review of Research in Open and Distance Learning, 2*(2), 76-91.

Hall, G. E., & Hord, S. M. (1987). *Change in schools: Facilitating the process* (pp. 1-22). Albany: SUNY Press.

Hanus, M. D., & Fox, J. (2015). Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance. *Computers & Education*, *80*, 152-161.

Harari, H. (Ed.). (1992). *Report of the Highest Committee for Science and Technology Education "Tomorrow 98"*. Jerusalem: MOE. [Hebrew]

Hardy, I. (2010). Critiquing teacher professional development: Teacher learning within the field of teachers' work. *Critical Studies in Education, 51*(1), 71-84.

Hinde, E. R. (2004). School culture and change: An examination of the effects of school culture on the process of change. *Essays in Education, 12,* 1-12.

Hultman, K. (1995). Scaling the wall of resistance. *Training .Development, 49*(10), 15-18.

Kaniuka, T. S., (2012). Toward an understanding of how teachers change during school reform: Considerations for educational leadership and school improvement. *Journal of Educational Change*. *13*(3), 327-346.

Kay, R. H. (2006). Evaluating strategies used to incorporate technology into preservice education: A review of the literature. *Journal of Research on Technology in Education, 38*(4), 383-408.

Kelly, A. E., Lesh, R. A., & Baek, J. Y. (2014). *Handbook of design research methods in education: Innovations in science, technology, engineering, and mathematics learning and teaching*. Routledge.

Koster, B., Brekelmans, M., Korthagen, F., & Wubbels, T. (2005). Quality requirements for teacher educators. *Teaching and Teacher Education, 21*, 157-176.

Kotter, J. P., & Cohen, D. S. (2012). *The heart of change: Real-life stories of how people change their organizations*. Boston: Harvard Business Press.

Krumsvik, R. J. (2014). Teacher educators' digital competence. *Scandinavian Journal of Educational Research, 58*(3), 269-280.

Lamote, C., & Engels, N. (2010). The development of student teachers' professional identity. *European Journal of Teacher Education, 33*(1), 3-18.

Lee, Y., & Lee, J. (2014). Enhancing pre-service teachers' self-efficacy beliefs for technology integration through lesson planning practice. *Computers & Education, 73*, 121-128.

Lewin, K. (1951). *Field theory in social science: Selected theoretical papers*. New York: Harper.

Lim, C. P., Chai, C. S., & Churchill, D. (2011). A framework for developing pre-service teachers' competencies in using technologies to enhance teaching and learning. *Educational Media International, 48*(2), 69-83.

Liu, S. H. (2011). Factors related to pedagogical beliefs of teachers and technology integration. *Computers & Education, 56*(4), 1012-1022.

Loughran, J. (2014). Professionally developing as a teacher educator. *Journal of Teacher Education, 65*(4), 271-283.

Mandinach, B. E. (2005). The development of effective evaluation methods for e-learning: A concept paper and action plan. *Teachers' College Record, 107*(8), 1814-1835.

Martin, B. (2015). Successful implementation of TPACK in teacher preparation programs. *International Journal on Integrating Technology in Education, 4*(1), 17-26.

Mckeon, F., & Harrison, J. (2011). Developing pedagogical practices and professional identities of beginning teacher educators. In T. Bates, A. Swennen, & K. Jones (Eds.), *The professional development of teacher educators*. London: Routledge.

Merseth, K. K., Sommer, J., & Dickstein, S. (2008). Bridging worlds: Changes in personal and professional identities of pre-service urban teachers. *Teacher Education Quarterly, 35*(3), 89-108.

Ministry of Education. (2003). *The program for computerization of the education system: stage 3*. Israel: MOE.

Ministry of Education. (2011). *The Adaptation of the Education System to the 21st century – A masterplan*. Jerusalem: MOE.

Ministry of Education. (2012). Regulations of the department for teacher training: preparation for deployment of the plan for adapting education colleges to education in the 21st century. Israel: MOE. [Hebrew]. Retrieved Dec. 2013 from http://cms.education.gov.il/EducationCMS/Units/HachsharatOvdeyHoraa/Hozrim/HearchutMumanuyot21.htm

Ministry of Education. (2015). *The Academia Kita Program*. Retrieved October 2016 from http://academia-kita.macam.ac.il/eng/Pages/default.aspx

Mioduser, D., Nachmias, R., & Forkosh-Baruch, A. (2008). New literacies for the knowledge society. In J. Knezek & J.Voogt (Eds.), *International handbook of information technology in education* (pp. 23-42). NY: Springer.

Mumtaz, S. (2000). Factors affecting teachers' use of information and communications technology: A review of the literature. *Journal of Information Technology for Teacher Education, 9*(3), 319–341.

Plomp, T., Anderson, R.E., Law, N., & Quale, A. (Eds). (2009). *Cross-national information and communication technology policy and practices in education* (2nd ed.). US: Information Age Publishing Inc.

Pope, M., Hare, D., & Howard, E. (2005). Enhancing technology use in student teaching: A case study. *Journal of Technology and Teacher Education, 13*(4), 573-618.

Rimon, O. (2010). Adaptation of the education system to the 21st century: The new plan of the Ministry of Education. *Hed Hachinuch, 12*, 40-45. [Hebrew] Retrieved Dec. 2013 from http://cms.education.gov.il/NR/rdonlyres/62E534AB-E474-4C60-B03A-FC02440B33B4/125568/Hinucdigitali.pdf

Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York: The Free Press.

Scherer, R., Siddiq, F., & Teo, T. (2015). Becoming more specific: Measuring and modeling teachers' perceived usefulness of ICT in the context of teaching and learning. *Computers & Education, 88*, 202-214.

Scott, W. R. (2013). *Institutions and organizations: Ideas, interests, and identities*. US: Sage Publications.

Siemens, G., & Tittenberger, P. (2009). *Handbook of emerging technologies for learning*. Manitoba, Canada: University of Manitoba.

Sung, T.K., & Gibson, D.V. (2015). Knowledge and technology transfer: levels and key factors. *International Conference on Technology Policy and Innovation (ICTPI)*. UK: Milton Keynes.

Surry, D. W., Ensminger, D. C., & Haab, M. (2005). A model for integrating instructional technology into higher education. *British Journal of Educational Technology, 36*(2) 327-329.

Surry, D. W., Ensminger, D. C., & Jones, M. (2002). *A model for integrating instructional technology into higher education.* Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Teclehaimanot, B., Mentzer, G., & Hickman, T. (2011). A mixed methods comparison of teacher education faculty perceptions of the integration of technology into their courses and student feedback on technology proficiency. *Journal of Technology and Teacher Education, 19*(1), 5-21.

Teo, T. (2010). A path analysis of pre-service teachers' attitudes to computer use: applying and extending the technology acceptance model in an educational context. *Interactive Learning Environments, 18*(1), 65-79.

Teo, T. (2011). Factors influencing teachers' intention to use technology: Model development and test. *Computers & Education, 57*(4), 2432-2440.

Thomas, T., Herring, M., Redmond, P., & Smaldino, S. (2013). Leading change and innovation in teacher preparation: A blueprint for developing TPACK ready teacher candidates. *TechTrends, 57*(5), 55-63.

Toledo, C. (2005). A five-stage model of computer technology integration into teacher education curriculum. *Contemporary Issues in Technology and Teacher Education*, *5*(2), 177-191.

Tondeur, J., van Braak, J., Sang, G., Voogt, J., Fisser, P., & Ottenbreit-Leftwich, A. (2012). Preparing pre-service teachers to integrate technology in education: A synthesis of qualitative evidence. *Computers & Education, 59*(1), 134-144.

UNESCO, (2009). *Guide to measuring information and communication technology (ICT) in education.* Paris: United Educational, Scientific and Cultural Organization. Retrieved December 22, 2013 from: http://www.uis.unsco.org/temlate/pdf/cscl/ICT/ICT_Guide_EN.pdf .

Voogt, J., Knezek, G., Cox, M., Knezek, D., & ten Brummelhuis, A. (2013). Under which conditions does ICT have a positive effect on teaching and learning? A call to action. *Journal of Computer Assisted Learning, 29*(1), 4-14.

Biographies

Dr. Orit Avidov-Ungar is the Head of Research Authority and senior lecturer at the School of Education Systems Management at Achva Academic College she is also a member of the faculty of the Open University in Israel. She heads the specialization in professional development at the Mofet Institute and is the academic advisor to the Ministry of Education in Israel management in the implementation of innovative technology systems and the professional development of teachers. Her research studies deal with the implementation of innovative technologies in education systems, the empowerment and professional development of teachers, and leading organizational change in education systems.

Alona Forkosh-Baruch is a senior lecturer at the Graduate school at Levinsky College of Education and a researcher at the Science and Technology Education Center in the School of Education, Tel Aviv University (Israel). She holds a Ph.D. in Science Education, an M.A. in Technologies in Education and a B.A in Psychology and in Education. Her research interest intersects several aspects of Information and Communication Technologies in education, from teachers', students', pre-service teachers' and teacher educators' point of view. Among her fields of research are: mobile technology in education and teacher education, social media in education and education in the social media era, teacher professional development and systemic implementation of technology in education. Her research studies deal with the implementation of innovative technologies in education systems, the empowerment and professional development of teachers, and leading organizational change in education systems.

Interdisciplinary Journal of e-Skills and Lifelong Learning **Volume 12, 2016**

Cite as: Silber-Varod, V., Eshet-Alkalai, Y., & Geri, N. (2016). Analyzing the discourse of Chais Conferences for the study of innovation and learning technologies via a data-driven approach. *Interdisciplinary Journal of e-Skills and Life Long Learning, 12,* 297-313. Retrieved from http://www.informingscience.org/Publications/3604

Analyzing the Discourse of Chais Conferences for the Study of Innovation and Learning Technologies via a Data-Driven Approach

Vered Silber-Varod, Yoram Eshet-Alkalai, and Nitza Geri
The Open University of Israel, Raanana, Israel

vereds@openu.ac.il; yorames@openu.ac.il; nitzage@openu.ac.il

Abstract

The current rapid technological changes confront researchers of learning technologies with the challenge of evaluating them, predicting trends, and improving their adoption and diffusion. This study utilizes a data-driven discourse analysis approach, namely culturomics, to investigate changes over time in the research of learning technologies. The patterns and changes were examined on a corpus of articles published over the past decade (2006-2014) in the proceedings of Chais Conference for the Study of Innovation and Learning Technologies – the leading research conference on learning technologies in Israel. The interesting findings of the exhaustive process of analyzing all the words in the corpus were that the most commonly used terms (e.g., pupil, teacher, student) and the most commonly used phrases (e.g., face-to-face) in the field of learning technologies reflect a pedagogical rather than a technological aspect of learning technologies. The study also demonstrates two cases of change over time in prominent themes, such as "Facebook" and "the National Information and Communication Technology (ICT) program". Methodologically, this research demonstrates the effectiveness of a data-driven approach for identifying discourse trends over time.

Keywords: mapping topics in the domain of learning technologies, academic discourse of learning technologies, culturomics, quantitative text analysis, data-driven discourse analysis, word frequency analysis

Introduction

In a world characterized by rapid technological changes, learning technologies researchers face a paradoxical situation in which they are examining how teachers and students are coping with frequently changing learning environments (Cuban, 1999). The paradox lies in the increasing rate of change in learning technologies within the education system, which makes optimal implementation difficult as well as conducting in-depth research on the effectiveness of utilizing these technologies.

Cuban (1999) refers to this technological paradox in the educational arena, claiming that experts have urged teachers to teach Information and Communication Technology (ICT) skills, such as using the Internet, e-mail, producing multimedia projects, and ap-

Editor: Janice Whatley

An earlier, shorter version of this paper was presented at the Chais conference 2016, in Raanana, Israel, and included in Y. Eshet-Alkalai, I. Blau, A. Caspi, N. Geri, Y. Kalman, & V. Silber-Varod (Eds.), *Proceedings of the 11th Chais Conference for the Study of Innovation and Learning Technologies 2016: Learning in the Technological Era*. Raanana: The Open University of Israel.

plications relevant to the constantly changing workplace. These demanding requests of experts led to the paradox of "increasing access and infrequent use" of technologies by teachers (Cuban, 1999, p. 68). In another article, Cuban, Kirkpatrick, and Peck (2001) explain that this paradox led to another one, namely that "new technologies will, paradoxically, sustain old practices" (Cuban et al., 2001, p. 830). Similarly, Eshet-Alkalai and Chajut (2009) showed that educators are dealing with a mixed effect of digital literacy over time: on the one hand, experience and training improve learners' performance with digital technologies, but on the other hand, for the skills that require critical and creative thinking (i.e., creative use of text and critical thinking about information), experience and exposure to information seem to have a negative effect on the users' performance (Eshet-Alkalai & Chajut, 2009). Research findings such as these reflect the difficulties in managing systemic decision-making on learning technologies, let alone research, in a world of fast-changing technologies.

The aim of the current study is to examine the nature of changes over time in learning technologies. We assume that a detailed longitudinal text-analysis of proceeding publications will reveal patterns of change through time in the major areas of research, theories, concepts, pedagogic approaches and research methodologies of learning technologies.

Background

Retrospective investigations of change trends in learning technologies are usually based on governmental reports, such as in Culp, Honey, and Mandinach (2005) or Bakia, Murphy, Anderson, and Trinidad (2011), the latter described the profile of ICT in the Israeli education system (Bakia et al., 2011, pp. 195-201). In a study on ICT in Israel, Elgali and Kalman (2011) present a qualitative analysis of twelve reports prepared by national educational ICT policy-making committees over three decades (1980-2010), as well as of interviews with key participants of these committees. Their longitudinal analysis illustrated the tendency of those committees to recommend adoption of "fashionable" and short-lived technologies, which led to frequent changes within relatively short time periods. Consequently, some technologies or pedagogies exhibited a "spiral" behavior, in which they appeared and disappeared over short periods of time (Elgali & Kalman, 2011).

Recently, scientometrics, which is the study of science, technology, and innovation from a quantitative perspective (Leydesdorff & Milojevic, 2015), was found to be useful for measuring the relationships between trends of change in learning technologies and research of learning technologies (Raban & Gordon, 2015; Van den Besselaar & Heimeriks, 2006). Using data-driven discourse analysis, we examine the patterns and changes as they are reflected in the texts of the articles published over the past decade (2006-2014) as part of the Chais Conferences for the Study of Innovation and Learning Technologies. Chais Conference is the main conference on this topic in Israel and is organized by the Center for the Study of Innovation in Learning Technologies at the Open University of Israel. Chais Conference is the place where leading researchers and developers in the field of innovation and learning technologies in Israel meet and present their research. The main themes of the conference in the past decade have been (Geri, Blau, Caspi, Kalman, Silber-Varod, & Eshet-Alkalai, 2015):

- Empirical examination of models of learning in technological environments;
- Study of the cognitive aspects of learning in technological environments;
- Examination of the effectiveness of teaching using content-driven applications;
- Study of the interactions between learner and computer;
- Technology as a bridge to overcoming distance and gaps;
- Study of the integration of technology into school and higher education systems in Israel;
- Examination of innovative paradigms in instruction and learning in organizations and industry;

- Learning technologies to advance people with special needs;
- Groundbreaking learning technologies;
- Innovative models of online learning;
- Open education resources; massive open online courses (MOOCs);
- Lifelong learning; learning technologies and the reduction of social gaps;
- Digital games as learning environments; crowdsourcing;
- Interaction on social networks;
- Economic, organizational, legal and ethical aspects of integrating learning technologies;
- Measuring the added value of new technologies and of information management in organizations and institutions;
- Resistance to adoption of new technologies in organizations and institutions.

Some of the themes have accompanied the research discourse throughout the nine years covered by this study, while others first appeared somewhere along the way. The conference proceedings reflect the state-of-the-art research in this field in Israel (Geri et al., 2015). Hence, discourse analysis of the Chais Conference articles may shed light on trends in the development of research in the field of learning technologies in Israel and provide answers to the following questions: What are the trends of change in the foci of learning technologies research throughout the years? What are the trends of change within the prominent themes? Which words represent the fundamental terms of this research field?

The current study demonstrates a novel use of a data-driven approach to analyzing trends in academic and research discourse regarding learning technologies. We aim to trace those features in the field of learning technologies as they are expressed in the several topics mentioned above,and to examine whether it is possible to identify trends of change within this area of research.

A Data-Driven Approach to Discourse Analysis

In the data-driven approach, researchers base their work on natural empirical data that derive directly from the studied corpus. In the past decades, a linguistic field known as 'corpus linguistics' has emerged (Sinclair, 1991, 2004). In corpus linguistics, in addition to the identification of structures within the linguistic system, the use of language is mapped in the sense of "trust the text", as Sinclair (2004) entitled his book – *Trust the text: Corpus and discourse*. Researchers are using a corpus-based analysis to describe the features of a particular language or genre. Johnstone (2008) applied such a heuristic approach to discourse analysis. She claimed that discourse analysis is a "systematic, rigorous way of suggesting answers to research questions posed in and across disciplines" (Johnstone, 2008, p. xiii).

In order to illustrate the analytical power of the corpus-driven approach, Michel et al. (2011) created a data set based on 5,195,769 digitized books dating between 1800 and 2000, accounting for approximately 4% of all books ever published in English (Michel et al., 2011, p. 176). Their analysis used a data-mining method, known as the n-gram, to measure cultural trends as expressed in linguistic choices in the texts themselves. An interesting example of research use of the data-driven approach of discourse analysis can be found in Johnstone (2008), whose study examined naming and terminology in relevant articles and revealed how researchers define long-term processes such as aging versus the necessity of special needs (Johnstone, 2008, p. 7).

The accelerated use of the corpus linguistics approach was the result of the development of sophisticated algorithms for natural language processing. The use of advanced statistical methods to analyze the data of large-scale textual databases makes it possible to identify patterns of change and to encode essential qualities expressed in the texts.

One of the spin-offs of corpus linguistics is called ‘culturomics’ (Michel et al., 2011). Culturomics quantitatively investigates massive digital arrays of written text and spoken language in order to examine cultural patterns in various disciplines (Bohannon, 2011). Culturomics also makes it possible to monitor trends of change and identify the unique lexical items in a particular field by analyzing the publications in that field (Soper & Turel, 2012a, 2012b; Soper, Turel, & Geri, 2014).

Another application of quantitative analysis of texts which has been gaining momentum in recent years is the semi-automatic assessment of exams (Bennet & Ben-Simon, 2005). This application was developed at Israel’s National Institute for Testing and Evaluation (Ben Simon & Safran, 2012). Following the development of corpus linguistics, automatic and semi-automatic tools that facilitate and accelerate analysis have appeared, such as Matrix (Rayson, 2003) and AntConc (Anthony, 2011). The use of such tools enables observation of an entire body of knowledge (the corpus) and not just certain elements of its features (Van den Besselaar & Heimeriks, 2006). In the era of Big Data, scholars from different disciplines have adopted diverse computational methods that use word frequency levels and the ratios between different levels of word frequency to make educated forecasts in economics and politics – for example on online news websites (Radinsky, Agichtein, Gabrilovich, & Markovitch, 2011; Radinsky & Horvitz, 2013).

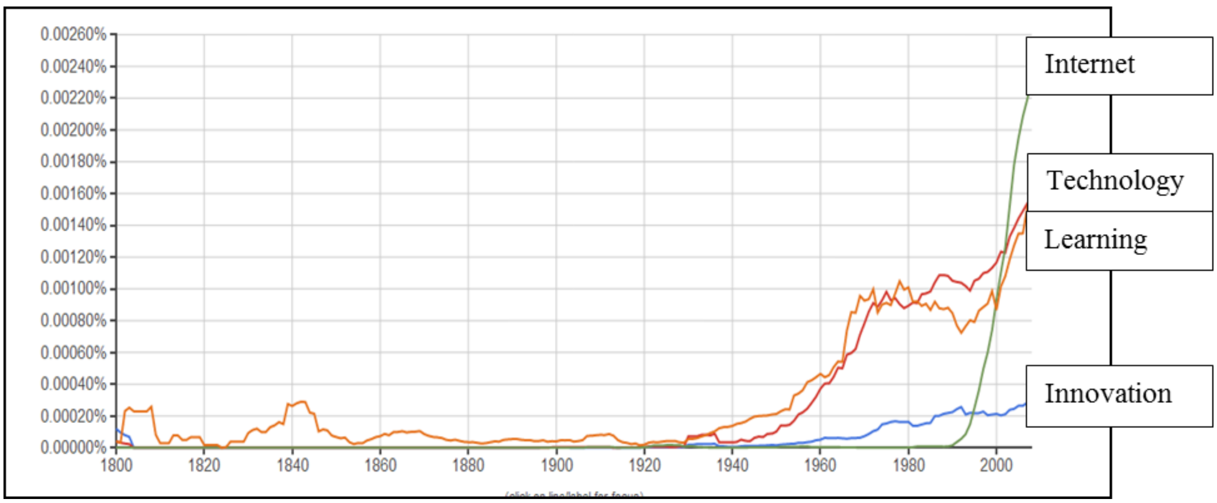


Figure 1. Frequency of use of four terms in the field of learning technologies – internet, technology, learning, and innovation – across two centuries, as retrieved from the database of books in Hebrew, using the Google Books Ngram Viewer platform

One of the requirements for a data-driven discourse analysis is that the chosen corpus must be representative of the topic under study (Livnat, 2012). In order to examine the potential of this kind of analysis for identifying trends of change over time in the field of learning technologies, we conducted a test of the Google Books Ngram Viewer (http://books.google.com/ngrams/info) in Hebrew. This is an open, diachronic database of books. Figure 1 shows the trends of change in the appearance of the words “learning”, “internet”, “technology” and “innovation” in Hebrew literature over the past 200 years (1800-2008) and the frequency ratios between them. The figure demonstrates the inherent potential of textual analysis, not only in identifying patterns of change over time for individual words, but also in identifying the appearance and disappearance of a word. Thus, for example, Figure 1 shows that the word “learning” was already in use in the 19th century (and presumably even earlier). The word “technology” also appeared in the 19th century, but its use increased significantly as of the 1930s, parallel to the appearance of the early television at the end of the 1920s. The word “innovation” starts to appear in the 1950s, whereas “internet" literally breaks through in the 1990s. Likewise, Figure 1 indicates the simultaneous growth of use of both "learning" and "technology".

Another study that applied a data-driven approach to identify trends in learning technologies research through the analysis of articles published on Google Scholar between 2000 and 2014, found that 3-7 years pass between the appearance of a technology and its comprehensive discussion in the research literature (Silber-Varod, Eshet-Alkalai, & Geri, 2016).

Research Method

The question examined in this study is: what are the trends of change over time in the foci of learning technologies research as reflected in the keywords and full text of the corpus of articles published at the Chais Conferences for the Study of Innovation and Learning Technologies research between 2006 and 2014? The study adopted a data-driven approach as described above. The encoding of the content was informative: to each word we attached the year of its appearance and the article it appeared in.

Corpus Data

The dataset for the study consisted of 1,407 keywords which were assigned by the authors of the 553 articles and poster abstracts (henceforth, both complete articles and poster abstracts are referred to as articles) of the Chais Conferences held between 2006 and 2014 (383 in Hebrew and 170 in English), as well as the full text of these articles.

Analysis of the full text of the articles was conducted through two methods. First, the generation of lists of words, as will be explained below, and second, examination of sequences of words in the articles. Examination of the frequency of sequences was conducted using the n-gram method. An n-gram refers to a sequence of words of length N. An n-gram analysis is based on calculating the relative frequency that a certain n-gram appears in a dataset (Soper & Turel, 2012a). This method examines the frequency of each word sequence, not only common phrases, or well-known collocations such as "high school" or "higher education", but also of any two or more words that appear in sequence in a text (such as the sequence "a significant difference was found", which appears in the dataset of the Chais Conferences 65 times in 39 different articles).

Word List Generation Process

One of the most common methods for processing information from texts is to prepare frequency lists for single words. However, this method of natural text analysis has many limitations. For example, in Hebrew, relying on the counting of only written words, i.e., any sequence of letters (grapheme) between spaces, will be misleading since *ha-lemida* "the learning" and *ba-lemida* "for learning" (each a single grapheme, since articles and prepositions are affixed to the noun in Hebrew) for example, will be counted as two different words. Hence, the unit of analysis in which natural language is processed, i.e., a text, must be the *lemma* – the basic form of the word. This means a process of uniting words that may differ in declension or conjugation but have the same meaning and are from the same lexical category. For example, in Hebrew the lemma *talmid* (student, [masc.]) is also the basic form for the feminine form (*talmida*), the plural form (*talmidim*), the possessives (e.g., *talmidav* – his students) and so forth. In other words, lemmatization unites words with prefixes and suffixes that perform various lexical and grammatical functions in Hebrew.

In this study, we performed the conversion of the words from their written form into their lemmas with the help of the National Institute for Testing and Evaluation, which has advanced tools for morphological analysis of Hebrew (for an overview of the tools comprising the processing system, see Ben-Simon & Cohen, 2011; Ben-Simon & Safran 2012).

Preparing the lists of words involved removing titles and sub-titles, authors' names, reference lists, figures, and tables, leaving only the body of the text to undergo the lemmatization explained above.

Initially, textual analysis was conducted separately for articles in Hebrew and in English, and later the findings from both analyses were manually unified in the process described in Table 1.

Table 1. Database of Chais articles 2006-2014

	Hebrew	**English**	**Full dataset**
Stage 1: Dataset based on Chais Conference articles published in the Proceedings for the years 2006-2014 (See Appendix A for list of conference proceedings and references)			
	480,306 tokens* 42,008 types**	249,769 tokens 10,886 types	730,075 tokens
Stage 2: Creating lists of words from the articles. The Hebrew dataset underwent lemmatization and function words were removed from the English dataset			
	382,941 tokens 12,310 types	124,237 tokens 10,431 types	507,178 tokens
Stage 3: Reduction of the dataset to: nouns, adjectives and proper nouns (e.g., learning, technology, education, collaborative, Facebook), and reduction of the list to 549 words in Hebrew with a frequency of 100 occurrences and above over the years. Integration of English words into the Hebrew list was conducted manually.			
	226,619 tokens 549 types	60,499 tokens 506 types	287,118 tokens

* Tokens = total number of occurrences of a single word in the corpus
** Types = the number of different words appearing in the corpus

Figure 2 illustrates the process of reducing the list of words as a result of lemmatization and of elimination of words with very low frequency. The recall ratio from the start of the process to its completion is 39%.

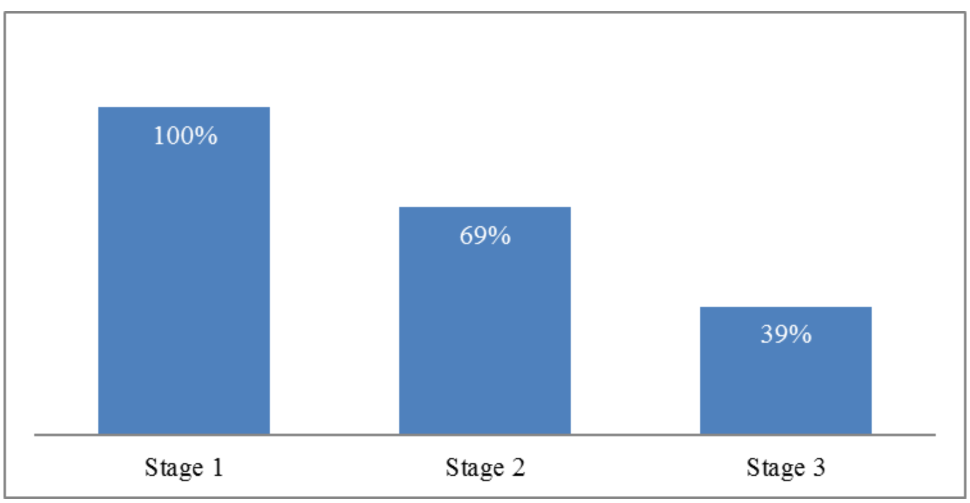


Figure 2: Illustration of the reduction process of the final word list that was used for the analysis

Data Processing and Analysis

We conducted the following tests on the corpus created in Stage 3 above: identification of the fundamental terms in the field of learning technologies; identification of the prominent words in each year; calculation of the dimension of change over time.

First of all, we determined the words which had a global frequency of over 2000 appearances over the years. With this method we expected to identify the words that appear a large number of times each year. A fundamental word was defined as one that was found at a distance of no more than a single standard deviation from its average relative frequency.

Prominent words are unusually frequent (or infrequent) words in the corpus in comparison with the words in a reference corpus. This allows us to identify characteristic words in the studied corpus. In the present study, calculation of the prominence of a word was carried out as a comparison of the frequency in a particular year as opposed to all the preceding years, using a statistical calculation known as log-likelihood (Rayson & Garside, 2000), which enables comparison between relative frequencies of words from different corpora.

Calculation of the dimension of change over time was done by comparing the log-likelihood data for each of the years 2011-2014 to the preceding years.

Findings

This section presents the findings, while distinguishing between trends that emerged from the analysis of the keywords to those that emerged from analysis of the full texts.

In the first part we present an analysis of the frequencies conducted on the keywords given by the authors of the articles.

In the second part we present first the findings for sequences at the level of 3gram found in the articles. We then present the keywords of the field of learning technologies and innovation as found in the word list generation process described above. We present results for frequency, relative frequency, average and standard deviation. Finally, we present the prominent words as of the year 2011 which were found through the log-likelihood calculations compared with the list of words for the year examined as opposed to the list of words for all the preceding years.

Keywords

The dataset consisted of 1,407 keywords assigned by the authors of the 553 articles. The most frequent keyword in the examined corpus was “collaborative learning” (40 instances). This was followed by “distance learning” and “E-learning” in 25 and 23 of the articles respectively. “Higher education”, “Wiki”, “ICT”, “social network”, “teacher training”, “Facebook” and “learning” were next with a frequency of appearance in only between 18 and 11 articles (Figure 3). The remaining 1,398 keywords appeared in 10 articles or less. Most of the items (1,061 keywords) were singletons. Accordingly, the frequency distribution presented in Figure 3 for all the 1,407 keywords (presented as key term codes in Figure 4) for the years 2006-2014, have a very “long tail” (Zipf’s law), which is a distribution typical of a natural textual corpus (Rayson, 2003, p. 36).

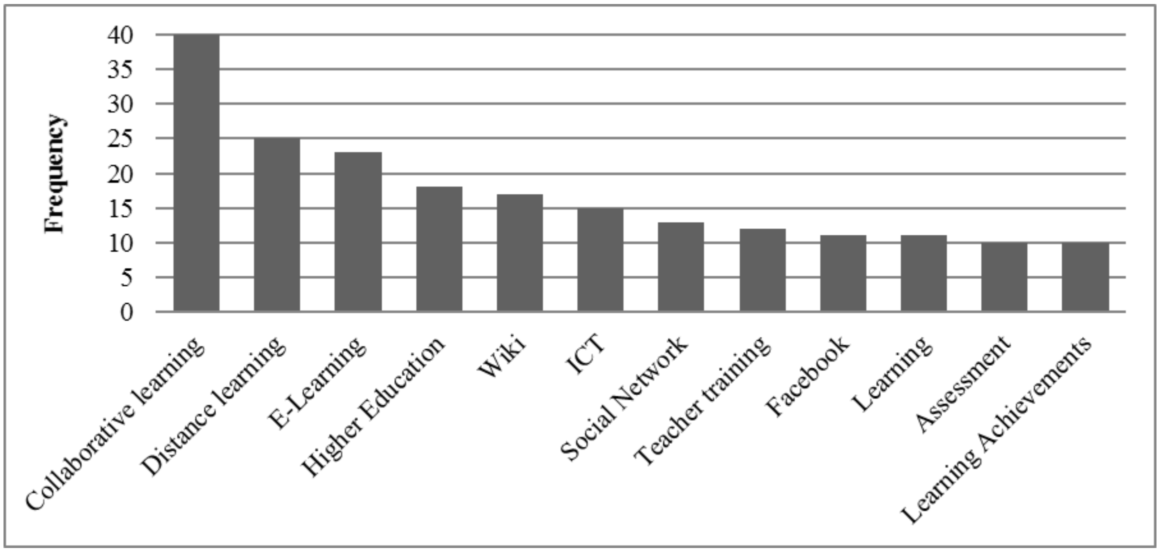


Figure 3. The most frequent keywords (>= 10 occurrences) in the proceedings, 2006-2014

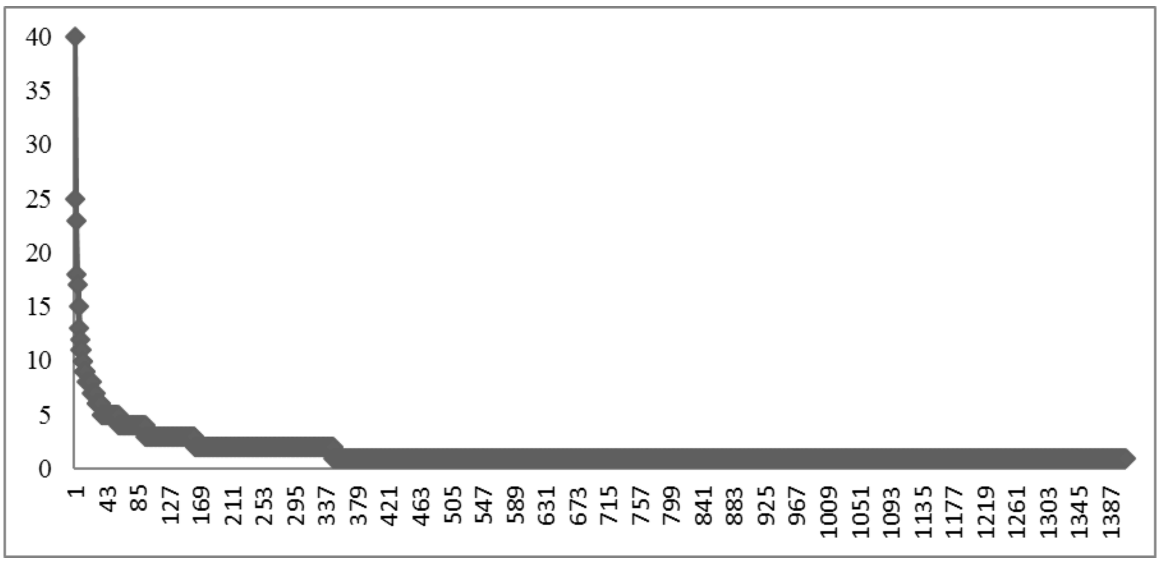


Figure 4. Frequency distribution of the 1,047 keywords, 2006-2014

Word Sequences

This test examined 614,035 different word sequences, and here too, their frequency distribution followed Zipf's law (less than 0.5% of the sequences appear 10 or more times). To the frequency data we added that dispersion data across the articles. For example, when examining sequences that appeared over 50 times and for a spread of more than 50 articles (about 9% of all the articles), we found only five different sequences. The main findings that integrate the data for frequency and spread are the most common sequence in the dataset was "face-to-face" (356 instances in 113 articles). The next 20 most frequent sequences are almost all typical of scientific writing (e.g., "found significant differences") rather than relating to content. However, the sequence in the 14th place is "teachers at schools" (95 instances in 11 articles) and in the 20th place – "higher order thinking", which appears 39 times in 17 articles.

Fundamental Terms in Chais Articles – The Building Blocks of Learning Technologies Research

Contrary to the two previous sections dealing with keywords and natural sequences in the text, in this section we present findings relating to the lists of words generated in the lemmatization process.

Table 2 shows the 18 most frequent words found in the articles, as well as the average and standard deviation of the relative frequencies for each year over nine years. As explained above, we determined the fundamental terms, which had a global frequency of over 2000 appearances over the years. A *fundamental word* was defined as one that was found at a distance of no more than a single standard deviation from its average relative frequency.

Our findings show that the word "research" is the most common, and is exceptional in that it reflects the fact that this is a corpus of research articles, as opposed to the other words, which reflect the objects of the research. A look at these words shows that they belong to the domain of pedagogy and not to that of learning technologies.

Table 2. Relative frequency averages and standard deviations for the 18 fundamental words in research on learning technologies as reflected in the Chais articles, 2006-2014

Lexeme	Average (%)	S.D. (%)
research	2.041	0.177
learning	1.888	0.240
student	1.902	0.442
teacher	1.471	0.503
pupil	1.381	0.436
teaching	1.103	0.199
usage	1.069	0.142
group	1.045	0.325
process	0.925	0.240
information	0.848	0.192
course	0.861	0.279
environment	0.816	0.183
home	0.769	0.306
book	0.748	0.293
technology	0.753	0.116
knowledge	0.757	0.140
system	0.752	0.269
activity	0.722	0.174

Figure 5 shows the relative frequency for each year of the words in Table 2. The data on the Y axis is presented in a log scale, since the log values are normalized and enable presentation of all 18 words within a range of log 1 (between -0.5 and 1.5). The figure illustrates the stability (lack of fluctuation) of the appearance of these words across the nine years studied.

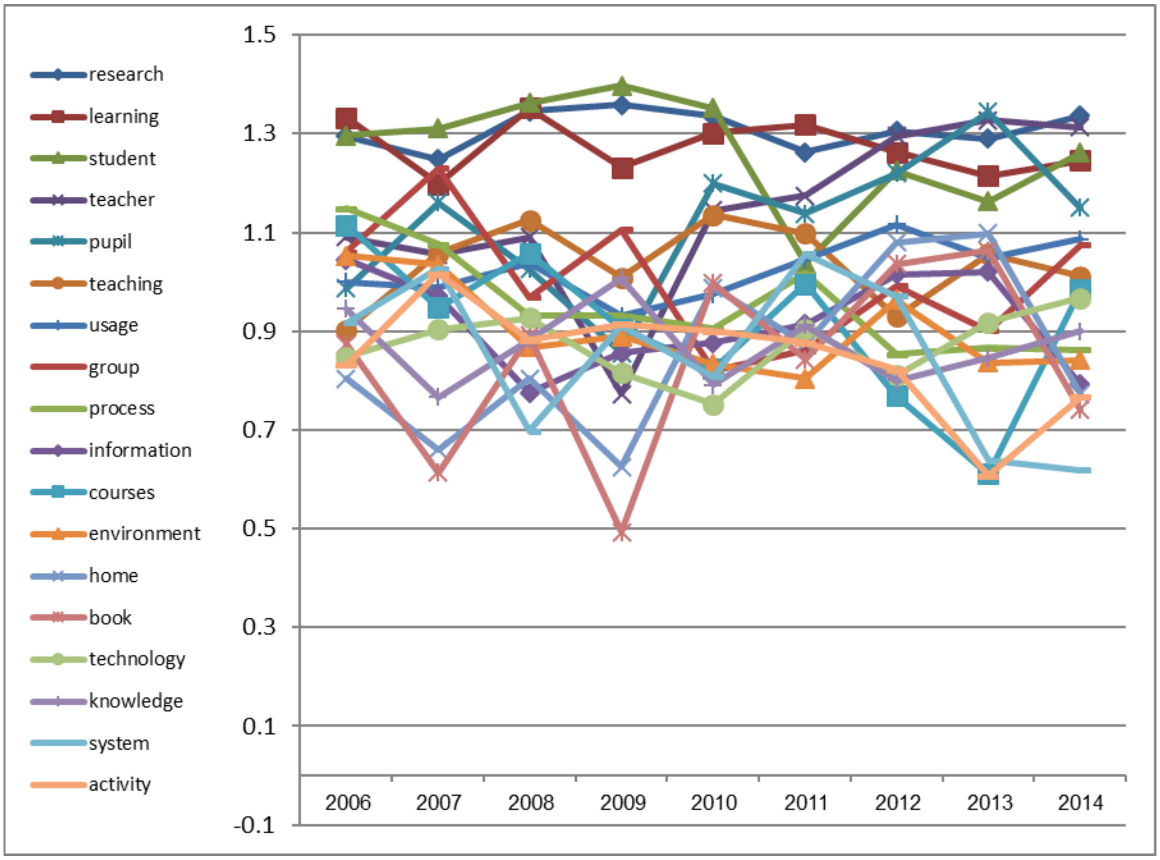


Figure 5. Relative frequency (on a log scale between 0.5-1.5) of the 18 fundamental words in research in learning technologies as reflected in the Chais articles (2006-2014)

Particularly High Frequency Words

Prominent words are those that in a particular year appeared with a noticeably high relative frequency compared to earlier years. Likewise, a word that did not appear in earlier years and appears for the first time in a particular year, even only a small number of times, is also given a high value on the log-likelihood calculation (Rayson, 2008). It is impractical to comprehensively show the data provided by these calculations and we have thus chosen to present two interesting cases that emerged from them (Figures 6 and 7).

Figure 6 shows the change over time in the appearance of the word “Facebook”. The data show that in 2011 this word is highly prominent, after not being mentioned at all in the years 2006-2010 in the Chais articles. Starting in 2011, it continues to be very prominent each year. The absence of the word “Facebook” from 2006 to 2010 and its spread from 2011 onward (despite the fact that Facebook started being used by the public already in 2006) can be explained by the fact that only in 2009 did it become possible to define languages other than English (including Hebrew) for use with personal profiles.

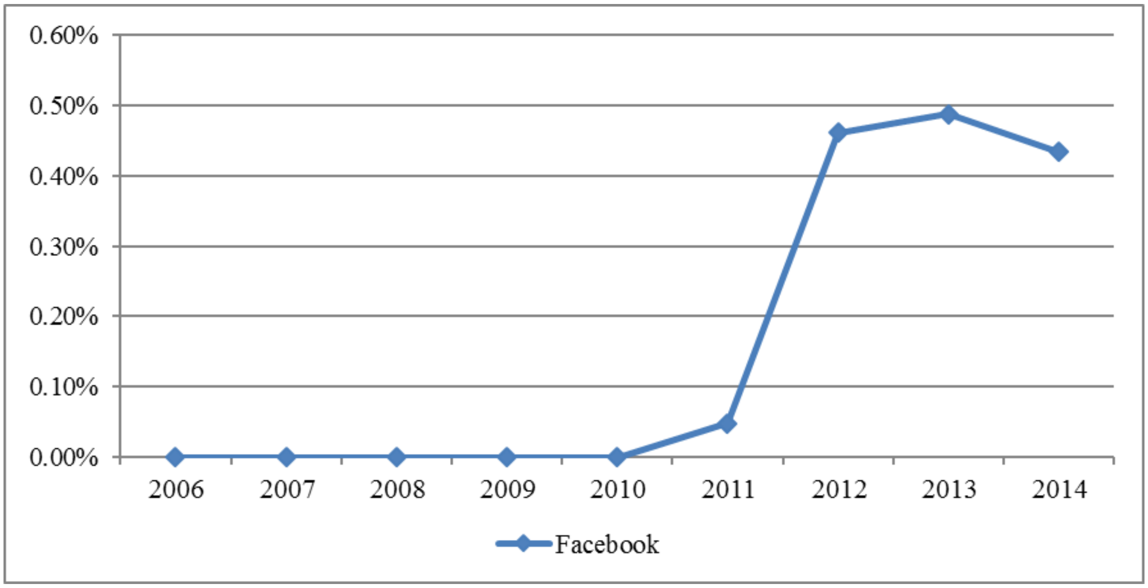


Figure 6. Development of the use of the word "Facebook" over the years

Figure 7 shows the five most prominent words in 2013: "classroom", "ICT", "program", "education", and "lesson".

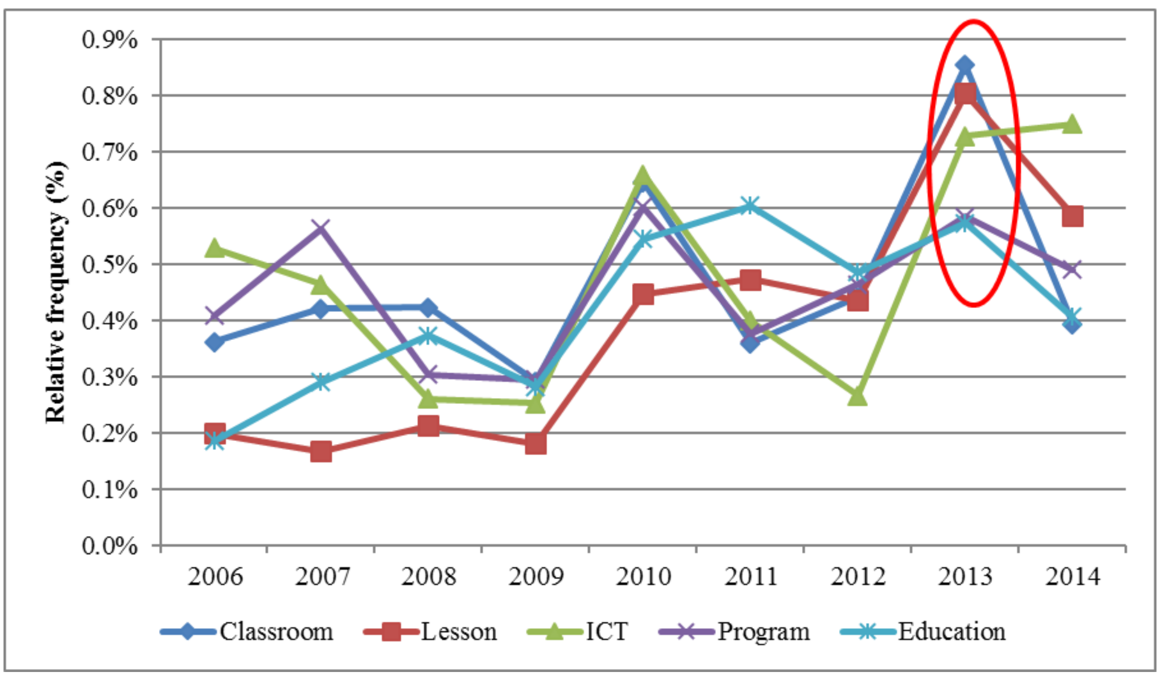


Figure 7. Five most prominent words in 2013

Discussion

This study applied culturomics, a new data-driven approach of research, to identify characteristics and trends of change over time in research discourse in the field of learning technologies in Israel, as reflected in the research articles presented at the Chais Conferences for the Study of Innovation and Learning Technologies over a period of nine years.

Considering the research questions about the patterns of change over time in learning technologies research, the findings demonstrate the inherent potential of a data-driven approach for:

- Identifying common terms and expressions in the domain of learning technologies (such as “collaborative learning”, “teachers”, “students”, “face-to-face”).
- Identifying a prominent trend of research for a particular year and linking of the technology to the date of its first appearance (e.g., “Facebook”, “the National ICT program”).
- Identifying research trends: the most common terms belong to the domain of pedagogy.

An exhaustive process of analysis of the data for all words in the corpus unexpectedly revealed that the most common terms in this research field (e.g., “pupil”, “teacher”, “student”) and the most common phrases (e.g., “face-to-face”, “collaborative learning”) are actually from the domain of pedagogy and not from the domain of technology. Thus, the picture that emerges from the current study is that this is not an area of research that actually focuses on technology, but rather on the pedagogical aspects of integrating technologies into teaching.

We analyzed two cases that demonstrate patterns of change within the prominent themes. First, the case of Facebook, which since 2011, emerged as a prominent trend of research (Figure 6). We conjecture that the option to define other languages in that platform significantly expanded the use of this social network, particularly among youth, which then led to research of “Facebook” with regard to learning technologies. Thus, the culturomics methodology managed to link the tool to the date of its first actual use in Israel. Second, we located the peak of “the National ICT program” and related terms in 2013 (Figure 7). Here, too, we can explain the findings obtained from the quantitative analysis as reflecting the many studies, which begun in 2012, following the launch of the National ICT program in Israel – “Adapting the Education System to the 21st century” (Ministry of Education, 2011), bringing the issue to the forefront of academic-educational debate in Israel. These findings demonstrate the potential of the data-driven approach for identifying trends of change in the field of learning technologies.

The findings of this study demonstrate the potential contribution of the data-driven approach to a retrospective understanding of the development of the field and the changes it is undergoing. With this approach we have presented an overview that constitutes the basis for future exploration of the changes over time in the use of terms and terminology, and such data can shed light on the “birth and death” of the noteworthy areas of interest in the field. This approach concurs with the trend of the growing use of data-driven analysis research in the era of Big Data (Michel et al., 2011; Radinsky et al., 2011; Radinsky & Horvitz, 2013).

Research Limitations and Directions for Further Research

In the current study, we showed that the corpus of academic articles with a scope of some 700,000 words had a Zipf-type frequency distribution, so that only 39% of the content appeared in a sufficient quantity to warrant processing. The relatively small number of words, their limited frequency and the range of only nine years hampered the analysis of discourse trends. It seems that the scope of the study’s dataset (the amount of text and the span of years covered) is not sufficient for drawing conclusions on trends, which based on a quantitative analysis. In a study by Silber-Varod et al. (2016), the authors propose a mixed methods model for big data discourse analysis in which culturomics analyses should involve both quantitative and qualitative methods. In studies in which the quantity of text or the span of years is relatively small, the main research method should be qualitative. Conversely, the broader the scope of the dataset, the more one can rely on the quantitative analysis (Silber-Varod et al., 2016).

Moreover, one should remember that the frequency of the use of words is influenced by the style of writing, by new terminology in the field, or by words belonging to a particular jargon. These factors might be the cause of the great variety in the choice of keywords the authors of the articles made, however we cannot learn about the reason for their use in this kind of study, and the interpretation of the findings requires the use of qualitative research methods or additional quantitative research tools. Further research might use language processing tools for semantic networks beyond the morphological analysis conducted in this study, since these tools may neutralize the influence of writing style or the use of synonyms.

In addition, the data we presented might have value as infrastructure data for studies that focus on a specific aspect such as "social network" and the technologies connected to it. Focused research questions such as these and others might benefit from the quantitative data generated in the current study. For this purpose, we have made the database of the 2006-2014 Chais conference articles available to discourse researchers on the Corpus Query Processor (CQP) (Hardie, 2012), which enables effective language and linguistic searching. This corpus can be found at: http://yeda.cs.technion.ac.il/HebrewCqpWeb/learningman/.

Conclusion

In the current study, several natural language processing tools were used to analyze the features and trends in the discourse of the Chais Conference articles pertaining to learning technologies research in Israel. The study shows that despite the relatively limited scope of the database, the use of relative frequency calculations and comparison of the prominence of lexical items over the years revealed trends and features in discourse on the subject. The main findings indicated the fundamental lexical items in the research discourse on learning technologies in Israel and showed that the most commonly used terms (e.g., pupil, teacher, student) and the most commonly used phrases (e.g., face-to-face) in this field reflect a pedagogical rather than a technological aspect of learning technologies. Furthermore, the study identified the most evident fluctuations in technological terminology across time and their association with what is taking place in the Israeli and global learning technologies arena, such as the rise of Facebook as a research area.

This research may contribute to developing retrospective understanding on how the research field of learning technologies has evolved over the past ten years in Israel. We showed data-driven insights on the pattern of change through time and the lifespan of research topics.

Methodologically, this research is in line with discourse data-driven research, which is an emerging trend in the Big Data era. To conclude, we suggest that expert reports could be strengthened by quantitative analysis of the textual database. Thus, this research also contributes to demonstrating the effectiveness of discourse analysis as a methodology for identifying evolving trends in fast-changing fields.

Acknowledgements

The article presents part of a study funded by the Research Authority of the Open University (Grant no. 504292). We wish to thank Dafna Amit for her help on processing the data, and Professor Alon Itay for help in uploading the database to the MILA (Knowledge Center for Processing Hebrew) website.

References

Anthony, L. (2011). Antconc version 3.2.4w. Center for English Language Education, Waseda University. Retrieved from: http://www.antlab.sci.waseda.ac.jp/software.html

Bakia, M., Murphy, R., Anderson, K., & Trinidad, G. E., (2011). International experiences with technology in education: final report. U.S. Department of Education, Office of Educational Technology, and the Office of Planning, Evaluation and Policy Development, Policy and Program Studies Service.

Bennet, R. E., & Ben-Simon, A. (2005). Toward theoretically meaningful automated essay scoring. Report to the National Institute for Testing and Evaluation (NITE). Retrieved from: https://nite.org.il/files/reports/e329.pdf

Ben-Simon, A., & Cohen, Y. (2011). The Hebrew Language Project: Automated essay scoring & readability analysis. *The 37th International Association for Educational Assessment (IAEA) Annual Conference*, Manila. Retrieved from: http://www.iaea.info/documents/paper_4e1237ae.pdf

Ben-Simon, A., & Safran, Y. (2012). The factorial structure of written Hebrew and its application to AES. Paper presented at *The annual meeting of the National Council of Measurement in Education (NCME)*. April 12-16 2012, Vancouver, Canada. Retrieved from: https://www.nite.org.il/files/reports/e382.pdf

Bohannon, J. (2011). Google Books, Wikipedia, and the future of Culturomics. *Science*, *331*(6014), 135. 14 January 2011. Retrieved from: http://www.terceracultura.net/tc/wp-content/uploads/2011/01/culturomics.pdf

Cuban, L. (1999). The technology puzzle. *Education Week*, *18*(43), 68-69.

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal*, *38*(4), 813-834.

Culp, K. M., Honey, M., & Mandinach, E. (2005). A retrospective on twenty years of education technology policy. *Journal of Educational Computing Research*, *32*(3), 279-307.

Elgali, Z., & Kalman, Y. M. (2011). Effects of ICT fashions on national educational technology policy. Paper presented at *the 6th Mediterranean Conference on Information Systems (MCIS)*, Limassol, Cyprus, September 3-5, 2011.

Eshet-Alkalai, Y., & Chajut, E. (2009). Changes over time in digital literacy. *Cyber Psychology & Behavior*, *12*(6): 713-715. doi:10.1089/cpb.2008.0264.

Geri, N, Blau, I., Caspi, A., Kalman, Y. M., Silber-Varod, V., & Eshet-Alkalai, Y. (2015). A decade of Chais conferences: Introduction to the IJELL special series of Chais conference 2015 best papers. *Interdisciplinary Journal of e-Skills and Life Long Learning*, *11*, 149-157

Johnstone, B. (2008). *Discourse analysis* (2nd ed.). Malden, MA: Blackwell Publishing.

Hardie, A. (2012). CQPweb – Combining power, flexibility and usability in a corpus analysis tool. *International Journal of Corpus Linguistics*, *17*(3), 380-409.

Leydesdorff, L., & Milojević, S. (2015). Scientometrics. In J. D. Wright (editor-in-chief), *International Encyclopedia of Social and Behavioral Sciences* (2nd ed.), Section 8.5: Science and Technology Studies, Subsection 85030. Micheal Lynch (ed.), Vol. 21, pp. 322-327. Oxford: Elsevier

Livnat, Z. (2012). *Dialogue, science and academic writing* (Vol. 13). John Benjamins Publishing.

Michel, J. B., Shen, Y. K., Aiden, A. P., Veres, A., Gray, M. K., Pickett, J. P., ... & Aiden, E. L. (2011). Quantitative analysis of culture using millions of digitized books. *Science*, *331*(6014), 176-182.

Ministry of Education. (2011). Adapting the educational system to the 21st century [in Hebrew]. (Master Document. Version 11 31-08-2011). Retrieved from http://cms.education.gov.il/NR/rdonlyres/79B5A8CF-F812-4A63-89BE-3BEFEB887EC5/142454/12.pdf

Raban, D. R., & Gordon, A. (2015). The effect of technology on learning research trends: A bibliometric analysis over five decades. *Scientometrics*, *105*(1), 665-681.

Radinsky, K., Agichtein, E., Gabrilovich, E., & Markovitch, S. (2011). A word at a time: Computing word relatedness using temporal semantic analysis. In *Proceedings of the 20th International Conference on the World Wide Web* (pp. 337-346). ACM. Retrieved from http://www.gabrilovich.com/publications/papers/Radinsky2011WTS.pdf

Radinsky, K., & Horvitz, E. (2013). Mining the web to predict future events. In *Proceedings of the Sixth ACM International Conference on Web Search and Data Mining* (pp. 255-264). ACM.

Rayson, P. (2003). *Matrix: A statistical method and software tool for linguistic analysis through corpus comparison* (Doctoral dissertation, Lancaster University).

Rayson, P. (2008). From key words to key semantic domains. *International Journal of Corpus Linguistics*, *13*(4), 519-549.

Rayson, P. & Garside, R. (2000). Comparing corpora using frequency profiling. In *Proceedings of the Workshop on Comparing Corpora, held in conjunction with the 38th Annual Meeting of the Association for Computational Linguistics (ACL 2000)*. 1-8 October 2000, Hong Kong, pp. 1-6.

Silber-Varod, V., Eshet-Alkalai, Y., & Geri, N. (2016). Culturomics: Reflections on the potential of big data discourse analysis methods for identifying research trends. *Online Journal of Applied Knowledge Management*, *4*(1), 82-98.

Sinclair, J. (1991). *Corpus, concordance, collocation* (Vol. 1). Oxford: Oxford University Press.

Sinclair, J. (2004). *Trust the text: Language, corpus and discourse*. Oxford: Routledge.

Soper, D. S., & Turel, O. (2012a). Who are we? Mining institutional identities using n-grams. *System Science (HICSS), 2012 45th Hawaii International Conference on*, 1107-1116. IEEE.

Soper, D. S., & Turel, O. (2012b). An n-gram analysis of communications 2000-2010. *Communications of the ACM*, *55*(5), 81-87.

Soper, D. S., Turel, O., & Geri, N. (2014). The intellectual core of the IS Field: A systematic exploration of theories in our top journals. In *System Sciences (HICSS), 2014 47th Hawaii International Conference on* (pp. 4629-4638). IEEE.

Van den Besselaar, P., & Heimeriks, G. (2006). Mapping research topics using word-reference co-occurrences: A method and an exploratory case study. *Scientometrics*, *68*(3), 377-393.

Appendix A: The Database

Eshet-Alkalai, Y., Caspi, A., Geri, N., Kalman, Y., Silber-Varod, V., & Yair, Y. (Eds.). (2014). *Learning in the technological era: Proceedings of the 9th Chais Conference for the Study of Innovation and Learning Technologies*, Raanana, Israel: Open University Press, 455 pp. (partly Hebrew). Available at: http://www.openu.ac.il/innovation/chais2014/program.html

Eshet-Alkalai, Y., Caspi, A., Eden, S., Geri, N., Yair, Y., & Kalman, Y. (Eds.). (2013). *Learning in the technological era, Proceedings of the 8th Chais Conference for Innovation in Learning Technologies Research*, Raanana, Israel: Open University Press, 454 pp. (partly Hebrew). Available at: http://www.openu.ac.il/innovation/chais2013/papers.html

Eshet-Alkalai, Y., Caspi, A., Eden, S., Geri, N., Yair, Y., & Kalman, Y. (Eds.). (2012). *Learning in the technological era, Proceedings of the 7th Chais Conference for Innovation in Learning Technologies Research*, Raanana, Israel: Open University Press, 441 pp. (partly Hebrew). Available at: http://www.openu.ac.il/innovation/chais2012/papers.html

Eshet-Alkalai, Y., Caspi, A., Eden, S., Geri, N., & Yair, Y. (Eds.). (2011). *Learning in the technological era, Proceedings of the 6th Chais conference on instructional technologies research*, Raanana, Israel: Open University Press, 393 pp. (partly Hebrew). Available at: http://www.openu.ac.il/research_center/chais2011/papers.html

Eshet-Alkalai, Y., Caspi, A., Eden, S., Geri, N., & Yair, Y. (Eds.). (2010). *Learning in the technological era, Proceedings of the 5th Chais conference on instructional technologies research*, Raanana, Israel: Open University Press, 381 pp. (partly Hebrew). Available at: http://telem.openu.ac.il/hp_files/chais/10/site.html

Eshet-Alkalai, Y., Caspi, A., Eden, S., Geri, N., & Yair, Y. (Eds.). (2009). *Learning in the technological era, Proceedings of the 4th Chais conference on instructional technologies research*, Raanana, Israel: Open University Press, 421 pp. (partly Hebrew). Available at: http://telem.openu.ac.il/hp_files/chais/09/articles.html

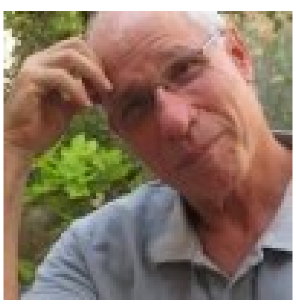
Eshet-Alkalai, Y., Caspi, A., & Geri, N. (Eds.). (2008). *Learning in the technological era, Proceedings of the 3rd Chais conference on instructional technologies research*, Raanana, Israel: Open University Press, 396 pp. (partly Hebrew). http:/telem.openu.ac.il/hp_files/chais/08/articles.html

Eshet-Alkalai, Y., Caspi, A., & Yair, Y. (Eds.). (2007). *Learning in the technological era, Proceedings of the 2nd Chais conference on instructional technologies research*, Raanana, Israel: Open University Press, 382 pp. (partly Hebrew). Available at: http://telem.openu.ac.il/hp_files/chais/07/site.html

Eshet-Alkalai, Y., Caspi, A., & Yair, Y. (Eds.). (2006). *Learning in the technological era, Proceedings of the 1st Chais conference on instructional technologies research*, Raanana, Israel: Open University Press, 291 pp. (partly Hebrew). Available at: http://www.openu.ac.il/innovation/chais2006/

Biographies

Vered Silber-Varod is a Research Fellow at The Research Center for the Study of Innovation in Learning Technologies, The Open University of Israel. She holds a B.A. in Political Science and French language and literature studies from the Hebrew University of Jerusalem, an M.A. with Magna Com Lauda in Hebrew language studies at the department of Hebrew and Semitic languages from Tel Aviv University, and a Ph.D. in Humanities from Tel Aviv University. Her research interests and publications focus on various aspects of linguistics, with expertise in speech prosody, acoustic phonetics, and quantitative analysis of written and spoken texts. Vered has over 10 years of experience as a Linguist at various institutes, including the ACLP – Afeka Center for Language Processing, Afeka College of Engineering. Personal site: http://www.openu.ac.il/en/personalsites/VeredSilberVarod.aspx



Yoram Eshet-Alkalai is a Professor at the Open University of Israel, Department of Education & Psychology. He is Head of the M.A. program in educational technology, and the former Head of the Research Center for Innovation in Learning Technologies in the Open University. He holds a B.A. in Archeology (Hebrew University), M.Sc. in Geology (Hebrew University) and Ph.D. in Earth & Environmental Sciences (City University of NY). For a decade, he was the Head of the Instructional Design Program in the Tel Hai Academic College, and a senior researcher in the Geological Survey of Israel. He has 15 years of experience in developing technology-based instructional solutions for educational systems in Israel and the USA. In this capacity, he was involved in the design of hundreds of simulations, data-bases, tutorials and large-scale curriculum integration projects. His major research and publications interests focus on cognitive aspects of working with digital technologies, digital games and design principles of computer-based learning environments. Personal site: http://www.openu.ac.il/Personal_sites/yoram-eshet.html

Nitza Geri is an Associate Professor at the Open University of Israel, Department of Management and Economics, and Head of the Research Center for Innovation in Learning Technologies. She holds a B.A. in Accounting and Economics, an M.Sc. in Management Sciences, and a Ph.D. in Technology and Information Systems Management from Tel-Aviv University. Nitza is a CPA (Israel) and prior to her academic career she had over 12 years of business experience. Her research interests and publications focus on various aspects of the value of information and knowledge, as well as adoption, implementation, and continued use of information systems, including strategic information systems, e-business, information economics, attention economy, knowledge management, value creation and the Theory of Constraints, managerial aspects of e-learning systems. Personal site: http://www.openu.ac.il/Personal_sites/nitza-geri.html