Perceptions of Teacher Educators Regarding ICT Implementation in Israeli Colleges of Education

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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 techno-

logical 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-

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 seg-

ment-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**

No.	Categories	2013		2015	
		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

Perceptions of Teacher Educators Regarding ICT Implementation

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

No.	Categories	2013		2015	
		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.

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