

Cite as: Cohen, A., Kalimi, S., & Nachmias, R. (2013). The use of digital repositories for enhancing teacher pedagogical performance. *Interdisciplinary Journal of E-Learning and Learning Objects*, 9, 201-218. Retrieved from <http://www.ijello.org/Volume9/IJELLOv9p201-218Cohen0861.pdf>

The Use of Digital Repositories for Enhancing Teacher Pedagogical Performance

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Abstract

This research examines the usage of local learning material repositories at school, as well as related teachers' attitudes and training. The study investigates the use of these repositories for enhancing teacher performance and assesses whether the assimilation of the local repositories increases their usage of and contribution to by teachers. One hundred and three teachers from four schools took part in this research. In the first school, a local open repository was developed and assimilated as part of the school institutional and pedagogical culture. In the second school, a local repository was developed and assimilated as well, but was divided into two sections: one that is open to all and the other closed. In the third school, a local repository was developed, but its use was not assimilated. The fourth school has no local repository at all. It was found that most teachers use a variety of repositories and mainly their local one, which allows them to effectively utilize their school's information resources and integrates their common experiences. Furthermore, the use of a local repository provides the initial results for set internal standards, leads to professional staff development, and enables institutional information management. Moreover, different types of use of the repositories were found: offline use involves exams, worksheets and presentations; online use includes viewing videos and listening to music files; interactive online use involves computer applications, simulation and remixes; and Creative use was displayed in the creation of adapted instruction processes. Finally, levels of teacher contributions to the repositories varied among the three schools that maintain them.

Keywords: Learning material repository, Local repository, Learning Object, Open Educational Resources (OER), Distance Learning

Introduction

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Development of Open Educational Resources (OER) and their use is a major issue in the future of education worldwide. Organizations and institutions have engaged in various projects, studies and conferences aimed to promote OER and the principles of open access to education (Atkins, Brown, & Hammond, 2007; Butcher, 2011; Downes, 2007; JORUM Team, 2006; Thomas, 2012).

Editor: Janice Whatley

An earlier, shorter version of this paper was presented at the Chais conference 2013, in Raanana, Israel, and included in Y. Eshet-Alkalai, A. Caspi, S. Eden, N. Geri, Y. Yair, & Y. Kalman (Eds.), *Proceedings of the Chais Conference for Innovation in Learning Technologies 2013: Learning in the Technological Era*.

Raanana: The Open University of Israel. <http://www.openu.ac.il/innovation/chais2013>

The continued growth of open educational materials in online repositories (OpenDOAR, 2012), which Hylén (2006) defined as “digitised materials offered freely and openly for educators, students and self-learners to use and re-use for teaching, learning and research,” contributes to the trends of sharing and reusing learning material and reflects a strategic opportunity to improve the quality of teaching and learning (Yuan, Macneill, & Kraan, 2008). These learning resources contribute to the accessibility of education, particularly in places and for populations with limited educational means. They also encourage a culture of flexible and collaborative learning, creativity, and collaboration which are necessary in the current era of dynamic information. This potential can be fulfilled when reuse of learning materials is encouraged, along with permission to use them in new and varying ways: customizing materials to the learning process; correcting materials; improving materials; adding to materials or removing from them; and combining multiple sources (Friesen, 2009; Hilton, Wiley & Johnson, 2010; Hylén, 2006).

The greater use and availability of digital technologies and open licensing seems to be generating wider acceptance for OER within individual and institutional teaching practices (Lane & McAndrew, 2010). However, despite such progress and despite the potential of OER to offer many benefits in teaching and learning, studies show that the reuse of the learning materials and their adaptation to user needs is relatively uncommon (Hilton, Lutz, & Wiley, 2012). Some claim that many educators are unaware of the growing repository of open educational resources, or that they are not convinced of their usefulness (Cape Town Open Education Declaration, 2007). In addition, concern exists that the abundance of information presented within the repositories will lead to confusion, inconsistency, and wasted time in the search for information, given the lack of a unified system for registration, licensing, and a catalog of learning objects (Nash, 2005), as well as the lack of appropriate tools for evaluating the quality and credibility of the materials and their management. Furthermore, even an OER of the highest quality is not useful for learners if its materials cannot be adapted to the learners’ own context (Richter & McPherson, 2012).

Although many resources are promoted as high quality and freely accessible, the critical threshold in OER usage has not yet been reached, and OER’s potential is not being fulfilled (Andrade et al., 2011; De Liddo, 2010; Hilton et al., 2012). However, it is impossible to ignore the educational revolution taking place worldwide, based on an online interactive collaborative culture in which educators develop educational resources and make them accessible and available on the web free of charge. Colleagues share successful pedagogical concepts in the belief that each of their peers is entitled to freedom of use, design, improvement, and distribution of educational resources indefinitely. Educators, students, and others who share this belief are part of a global effort to make education more accessible and more efficient.

This paper focuses on the teachers’ communal attitudes towards OER, their OER usage, and their training in this regard, with an emphasis on the examination of local (school) repositories to uncover the use of these repositories in assisting teachers’ pedagogical work. We aim to assess whether implementation of a school-based repository (in contrast with the global repository openly available online) increases the use of learning materials. Accordingly, the research questions are the following: (a) which repositories do teachers use, and to what extent? (b) To what extent are the local repositories being used at various schools? (c) How do the teachers use the local repositories? (d) What types of materials do the teachers contribute to the repositories? (e) What is the contribution of the teacher training to the materials’ reuse?

Background

Open Educational Resources (OER)

The scope of using learning technologies is clearly increasing. With the expansion of technological possibilities in general, and the incorporation of web-based tools in particular, many teachers integrate applications and Open Educational Resources (OERs) in order to enrich their instructional material. The World Forum of UNESCO Chairs (2002), 'Academics across Borders,' defined OER as "teaching/learning materials and other facilities freely available on the web." OER aims to serve as a technology-enabled academic cooperation mechanism for the open, non-commercial provision of a broad range of lecture material, textbooks, references and readings, simulations, experimental demonstrations, syllabi, teachers' guides, and other materials for all levels of education, from kindergarten through higher education (World Forum of UNESCO Chairs, 2002). OER provides a strategic opportunity to improve the quality of education, as well as to facilitate policy dialogue, knowledge sharing and capacity building (Shmueli & Cohen, 2012).

OER are educational materials that are licensed to be used free of charge by others. These resources include learning materials characterized by Open Source format, lesson plans, textbooks, games, software, and other materials that support teaching and learning. Educators who develop and share educational resources in these repositories create a tool through which everyone can contribute to global knowledge (Cohen, Shmueli, & Nachmias, 2011). An increasing number of institutions and individuals worldwide are producing and publishing OERs (Hilton et al., 2010). MIT's Open Courseware was the first initiative to expose its courses' learning materials to all. Many other initiatives followed this trend, such as Khan Academy, Washington's Open Course Library, Massive Open Online Courses (MOOCs, for example, Coursera, Udacity, Udemy and MITx), and open repositories (e.g., MERLOT and Globe).

OER as a phenomenon may be seen as a part of a larger trend toward openness, including more well-known and established movements such as open source software (OSS) and open access (OA). Concepts like open content, open data, and open resources, along with transparency and easy access to data and information, are gaining significance (Johnson et al., 2013). A general awakening is taking place in the learning community (Downes, 2007), this with the emergence of a growing trend of sharing and using online learning materials (Hylén, 2006; World Forum of UNESCO Chairs, 2002). Indeed, Wiley, Green, and Soares (2012) claim:

"We are in the midst of a revolution in education. For the first time in human history we have the tools to enable everyone to attain all the education they desire. And best of all this education is available at almost no cost. The key to this sea change in learning is open education resources, or OER".

OERs offer a broad range of open and flexible learning opportunities, thereby facilitating informal and lifelong learning. OERs also yield strong social benefits, since they can bring learning opportunities to disadvantaged and excluded groups of learners. The sharing and use of OERs may result in increased efficiency and quality in the development of new materials, courses, or programs. OERs may also increase efficiency by reducing duplication and promoting inter-institutional collaboration and sharing. Through this channel, high-quality learning resources are produced and shared at lower cost. Typically, OERs also drastically reduce the cost of accessing learning resources for students, teachers, and institutions. Using, producing and sharing OERs may benefit individual learners, teachers, institutions, countries, and the global community at large. In fact, this practice can be seen as a systemic transformation in itself, since it affects all parts of the educational system (Hylén, Damme, Mulder, & D'Antoni, 2012).

Open Online Courses

Many academic institutions including the world's leading universities offer open online courses to the general public, containing learning materials, recorded lessons conducted on campus, quizzes, lectures, transcripts, and other materials (Open Courseware: OCW). These materials are uploaded to various platforms. The use of these platforms enables viewing and engaging in the courses anywhere, anytime. The first OCW initiative was of the MIT (MIT Open Courseware). In 2002, it opened up 50 courses to the general public for free. Only a year later, 500 MIT courses were offered for free, and nowadays (Wiley & Gurrell, 2009) this institution offers more than 2,000 courses in which about 125 million people around the world are enrolled. These courses are offered in a variety of disciplines and include all course materials and activities, lacking only the presence of the instructors. Other such initiatives include Connexions, which delivers content for schools, educators, students, and parents; the Saylor Foundation, which offers free college courses in various fields; and Academic Earth – a corporation of several leading universities (Yale, Stanford, MIT, Berkeley, Carnegie Mellon, and Dartmouth College) offering a collection of hundreds of recorded courses. These courses content services the educational needs of learners of all ages.

Over the last years, especially in 2012, there has been a considerable increase in the number of MOOCs on the web including courses in education and teacher training (e.g., First Year Teaching (Elementary Grades/ Secondary Grades) - Success from the Start course; Foundations of Teaching for Learning courses which are offered by Coursera. According to the Horizon Report (Johnson et al., 2013), MOOCs are expected to grow in numbers and influence within the year 2014. Nonprofit organizations such as Mitx and Edx or for-profit commercial entities (e.g., Coursera and Udacity) are partnering with multiple institutions to create an online platform for course enrollment and distribution (Allen & Seaman, 2013). These courses are open to the public worldwide without threshold conditions and generally without tuition fees. The courses are taught by leading professors from top universities in the world such as Stanford, Harvard, and MIT, and they allow flexible learning any time and any place, with tasks that are integrated into the course structure. The course structure and scope varies according to course characteristics and the instructor's preferences. Great emphasis is placed on the course selection, its instructor, high quality of lesson recordings, and a friendly design interface. In such courses, a culture of collaborative, social learning and peer assessment contributes to the learning processes. This social learning, combined with social tools for learning management (such as discussion groups and management tools for assessment processes), allows provision to masses of students without the presence of a lecturer. These courses emphasize an active, social, and cooperative learning experience for the students from different cultures. This learning model encourages lifelong learning by enabling learners with different interests and needs to benefit from the course according to their respective needs (Cormier & Siemens, 2010). Consequently, one of the most appealing promises of MOOCs is that they offer the possibility for continued, advanced learning at zero cost, enabling students, life-long learners, and professionals to acquire new skills and improve their knowledge and employability.

Open Educational Repositories

Digital repositories are systems that enable the storage, discovery, and retrieval of metadata and/or electronic materials stored at a local or distributed level (JORUM Team, 2006). More specifically, learning materials repositories or learning object repositories (LOR) are systems that manage the access to reusable learning content (Monge, Ovelar, & Azpeitia, 2008).

The new trends of openness and sharing within learning communities in the Web 2.0 age affect the design of new models for learning material repositories that reflect the social, personal, flexible, dynamic characteristics of learning and knowledge. The purpose of a digital repository is not

only to store catalogued learning materials and distribute them, but also to allow sharing and reuse (Duncan, 2003). Meta-data (data about data) is critical for such sharing and reuse. Meta-data is descriptive information about the learning material. Therefore, it is essential that each element of learning material will have consistent meta-data fields (Shmueli & Cohen, 2012).

The material distribution and sharing circles model (Shmueli, Reisman, & Sperling, 2010) categorizes three main types of online learning materials repositories. The first are local repositories, containing learning materials and meta-data about these materials – these repositories can be found in many institutions that develop and store learning materials for their own community (e.g., MIT Open Courseware) (Abelson, 2008). These repositories were established to serve local communities and answer specific pedagogical needs; therefore, the learning materials they gather were developed according to learners' needs in order to improve the process of learning. They are normally designed by experts aware of the institution and the learners' needs. Development of learning materials is usually undertaken by a pedagogical development team. Production of this sort usually uses a substantial amount of the budget for development available to institutions or other public bodies and is, thus, usually kept on a small scale. The second type of repositories is portals that allow access to several online repositories, such as MAOR, MERLOT (Malloy & Hanley, 2001) and Open Courseware Consortium (Taylor, 2007). These portals contain only the meta-data and allow a wider use of learning materials developed and stored in local repositories. These fields describe the material and the possibilities for its use, so that objects may be located using keywords, retrieved, and examined to see whether it suits learners' needs. The third type is international associations and consortiums that enable the sharing of learning materials among repository networks worldwide. Consortiums such as Globe enable users to broaden their search between international repositories according to meta-data standards, via means such as automatic content harvesting or search request as federate-search and sharing of learning materials. These consortiums' features, which characterize objects and include information fields describing materials, expand the use of learning materials by retrieving these materials via modular construction of materials and their integration into new learning processes according to learners' needs.

Learning materials repositories provide a platform for the sharing of educational resources on the web (Foster & Gibbons, 2005), but not all of them provide mechanisms for building community dynamics around their resources. Yet the community dimension and its social dynamics have been found to be important in the success of these repositories (Sicilia, García-Barriocanal, Sánchez-Alonso, & Cechinel, 2010). Many repositories are effectively created by their users and offer tools that enable users to publish their opinion and comments regarding the learning materials – whether by vote, frequency of use, or peer review. Using these tools, one may learn of an object's quality or receive other users' recommendations of the best ways to use materials. User involvement and exchange of information between learners creates a learning community that shares information of great value (Monge et al., 2008). These communities are created across borders and add a great deal of informal knowledge to formal information. The exchange of information and recommendations among participants increases the potential to benefit from others' knowledge. Moreover, the combination of different evaluated learning material offers the learner an effective, high-quality learning process. Community members' involvement in the repository environment increases the motivation to use the learning materials and to support the community by passing on valuable informal knowledge to other users (Shmueli & Cohen, 2012).

Reuse of OER

As the world becomes increasingly connected, OERs provide a significant opportunity to share both content knowledge and pedagogical practice (Hilton et al., 2010). OER activities are spread throughout all educational sectors (Hylén et al., 2012). Instructors may integrate learning materials according to specific pedagogical demands, fill in information, and construct a new learning

process that is tailored to the needs of different target audiences. As a result, learners and international content providers form communities that share learning materials. Materials can be exchanged and expanded substantially by using basic meta-data to characterize them. Openness from institutions and organizations to the distribution of information contributes to the international trend toward information sharing and the creation of collaborative learners' communities (Shmueli & Cohen, 2012). According to Gropper (2010), the main factor to create a significant contribution of technology into the learning process in school is not the technological infrastructure, but the number of teachers who use technology wisely. Therefore, the investment in OER in education must include a teacher training component, enabling teachers to use open learning materials effectively to promote their pedagogy. Furthermore these processes require time to enable the teaching staff to acculturate to it (Ayalon, Shertz, & Carmeli, 2007)

'Open' generally means that the resource is freely available to others to reuse in different contexts (McMartin, 2008). However, the word 'reuse,' as it pertains to openness, is poorly understood and can describe several different types of use (Downes, 2007; Hylén, 2006). From a legal perspective, the critical question with regard to the different definitions of 'reuse' is, 'do I have permission to do X with this OER?' Wiley (2009) identified four 'R's that clarify distinctions of what an OER formally permits by its license. The four 'R's include the following: Reuse – the most basic level of openness. People are allowed to freely use all or part of the unaltered, verbatim work (e.g., to download an educational video to watch at a later time); Redistribute – people can share copies of the work with others (e.g., email an article to a colleague); Revise – people can adapt, modify, translate, or change the form of the work (e.g., transform a book written in English into a Spanish audio-book); and Remix – people can take two or more existing resources and combine them to create a new resource (e.g., take audio lectures from one course and combine them with slides from another course to create a new derivative work).

There are many advantages inherent in online repositories and the millions of sites containing materials that can help in the process of teaching higher education (Schell & Burns, 2002), as well as elementary and secondary school (Diers, 2011; Martinez, 2010; Richter & Ehlers, 2010). Despite these benefits, the time wasted during information searches and the absence of appropriate tools to evaluate quality, reliability, and management of information is a risk. Moreover, these repositories offering accessibility and availability of learning materials are not always easy to navigate, due to the lack of a uniform system and learning materials catalogue (Nash, 2005). The aim of this study is to assess whether implementation of a school-based repository (in contrast with the global repository openly available online) increases the use of learning materials in schools.

Methodology

The study was conducted on 103 teachers from four public elementary schools in the center of Israel in 2013. All four schools participate in the national ICT program and receive training through workshops and seminars in the field of integrating technology in education. In the first school, a local repository was developed and assimilated as part of the school's institutional and pedagogical culture; the materials are open to the general public on the web as part of the school portal. In the second school, a local repository was developed and assimilated as part of the institutional and pedagogical culture as well; however, in this case, some of the materials are available to the staff only, and some are open to the general public. The third school also developed a local repository, but its use was not assimilated as part of the organizational and pedagogical culture. All these repositories were developed in-house by the school teaching staff and are considered to belong to the school. The fourth school has no local repository. The schools were identified and selected based on reports of the regional ICT center.

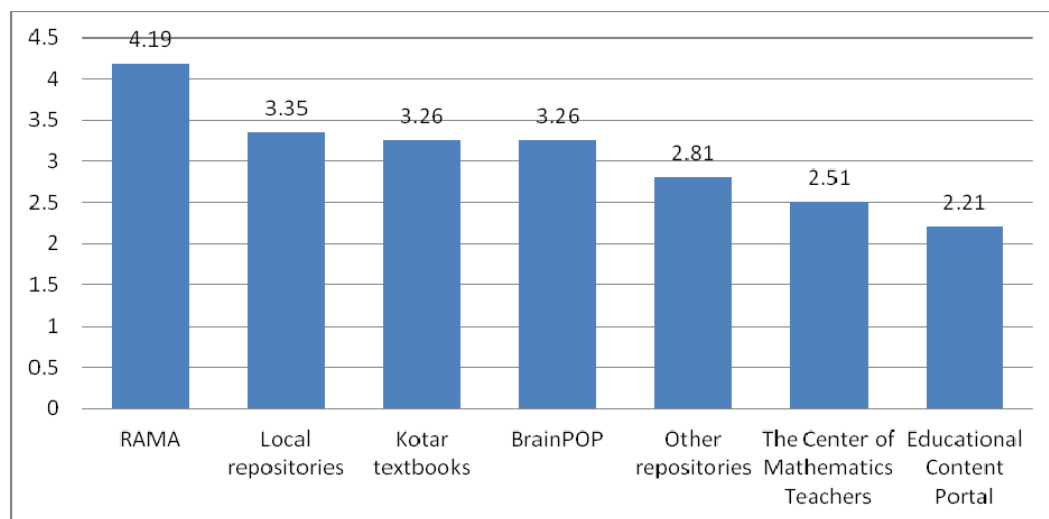
The research tool was an online questionnaire that was produced through Google Docs, followed by selective interviews to further understanding of the results. The questionnaire [in Hebrew] included background information about the teachers, including their training, guidance, and information on how they use open repositories on the web and their schools' local repositories. The questions regarding the teachers' usage were based on Wiley four 'R's.

The online questionnaire was distributed to all 103 teachers from four schools in 2013 in order to answer the research questions, with a 100% response rate. After receiving the data and processing it through SPSS (Statistical Package for the Social Sciences), personal semi-structured interviews (two teachers from each school who were found to be active in the repositories and were selected for interview) were carried out to improve our understanding of the use of the repositories as a pedagogical tool in the teachers' work, the significance of the local repository's communal implementation, and the impact of the teacher training on the learning material's usage and on the teachers' contribution to the repository. The interviews were carried out at school, the teacher's natural environment, in order to give a sense of comfort.

Findings

Most of the teachers use a variety of repositories (96% of the teachers of all four schools). Three main groups of repositories were identified: (1) repositories of the Ministry of Education (e.g., the Educational Content Portal, The Center of Mathematics Teachers, and RAMA-The National Authority for Measurement and Evaluation in Education); (2) repositories of content providers (e.g., Kotar Textbooks, the online library of the Center for Educational Technology, and BrainPOP – the Animated Educational Site for Kids) and (3) local (school) repositories.

Figure 1 shows that maximum use is being made in two kinds of repositories: the first is RAMA's repository, which provides evaluation and measurement materials for teachers, and the second are the local repositories, which were developed by the schools' own respective teaching staffs. In addition, the teachers use the Kotar textbooks and BrainPOP repositories developed by content providers. The teachers also mentioned other repositories, such as the professional development of teachers centers (PISGA Centers), YouTube, and Kaye College. The lowest usage was found regarding the Educational Content Portal, which was established as part of the national program aimed at "adjusting the education system for the 21st century" in order to give access to a variety of digital content tailored to the curriculum.



**Figure 1. Types of repositories used by teachers
(1= to a slight extent – 5 = to a great extent)**

Examination of the extent to which teachers use the local repositories reveals differences among schools (Figure 2). The teachers of the first two schools, which have assimilated local repositories as part of the school institutional and pedagogical culture, use the repositories to the highest extent. It was interesting to find that the teachers of the fourth school, which does not have a local repository, referred to the school website as a local repository. Analysis of variance (ANOVA) was performed in order to find out whether these differences are significant. The analysis proved significant differences among schools ($\text{sig} < .05$).

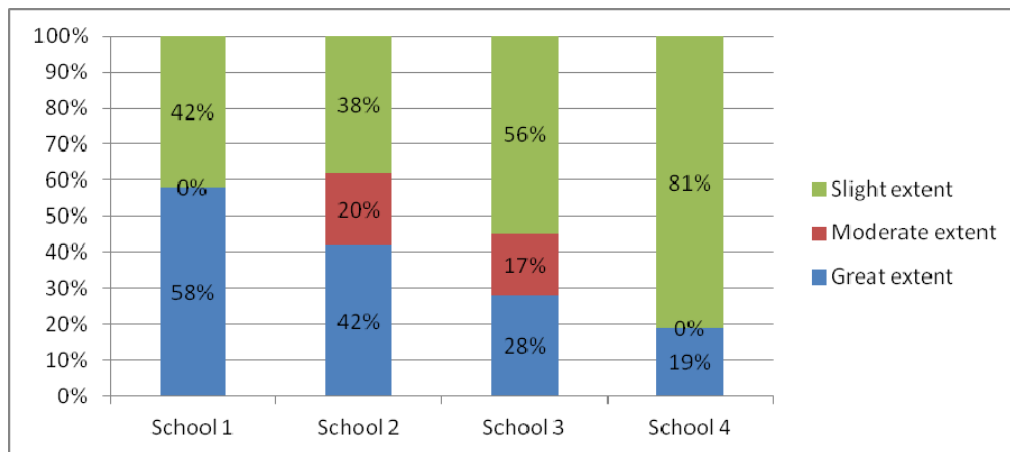


Figure 2. Usage extent of the local repository in schools (Slight, moderate and great extent)

Furthermore, the extent of teachers' uses of the schools' own repositories was examined. Varied levels of usage were found in all three schools (see Figure 3), without significant differences between the schools. Such usage varied from merely background use (4.25 on average where 1 is a slight extent and 5 is a great extent) and offline use in order to print worksheets and tests (4.29 on average), through the use of online materials from the repositories during the class lessons for presentations (4.12 on average), videos and music files (3.86 on average), or interactive resources, such as animations and applets (3.22 on average). Teachers also use the resources as a basis for the construction of a new lesson which was adapted for the students (3.95 on average), or create a combined array of various teaching resources (3.72 on average). In addition, it was

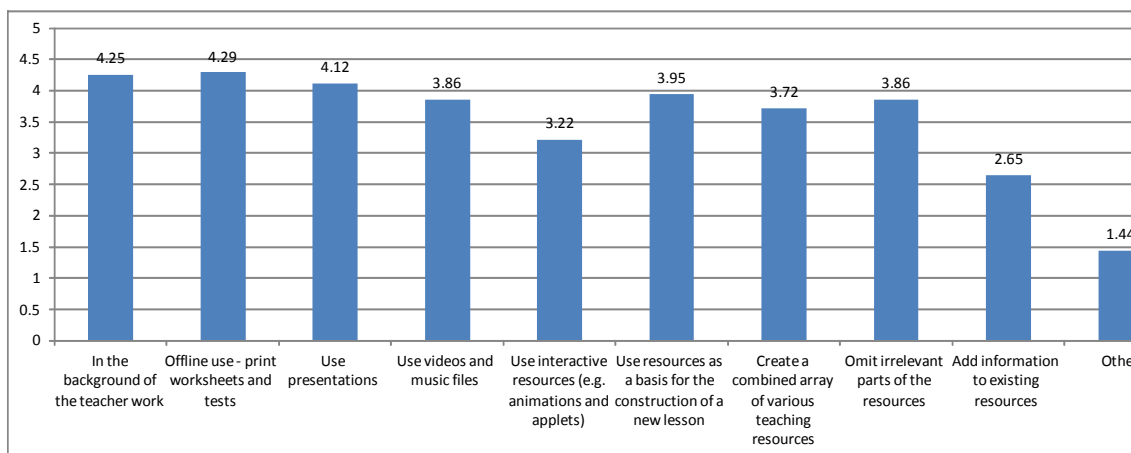


Figure 3. Teachers' uses of local repositories (1= to a slight extent – 5 = to a great extent)

found that most teachers omit irrelevant parts of the resources (3.86 on average) and only few of them add information to existing resources (2.65 on average) (Figure 3).

The community activity was examined in two ways: teachers' contributions to the repositories and their sharing new reuse and remix of resources with other members of the community and colleagues. The findings uncover a substantial contribution of teachers to the local repositories: 74% of the teachers from the four schools indicated that they contribute to the local repository, compared with only 26% who do not contribute at all (Figure 4).

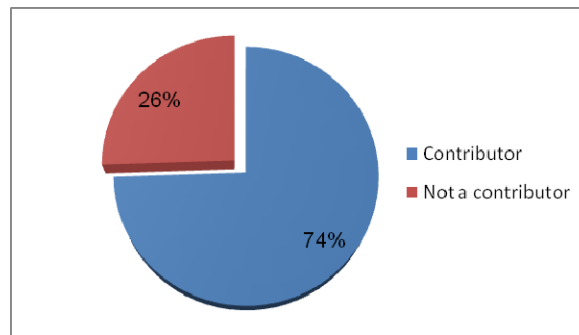


Figure 4. Teachers' contributors to the local repositories

Furthermore, it was found that teachers tend to contribute more materials to the open section of the local repository and not to the closed section. Consequently, these materials are accessible not only to the school community but also to the general public. However, the contribution to the public repository was the lowest (Figure 5). No significant differences were found among schools regarding to these findings. Regarding contribution intensity, 76% of the contributors stated that they contribute in a great extent level to local repository: 45% contributed to the open section and 31% to the close section. A high 86% stated that they contribute materials to the public repository, to a slight extent (Figure 6).

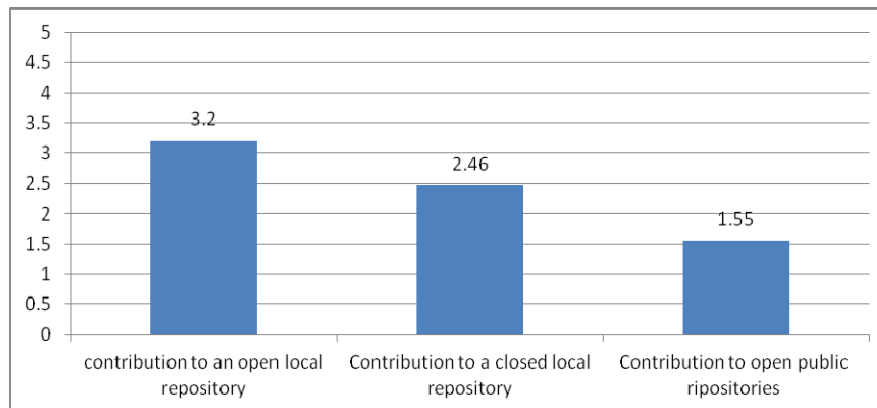


Figure 5. Contribution to a local (an open vs. closed) and public repository (1= to a slight extent - 5= to a great extent)

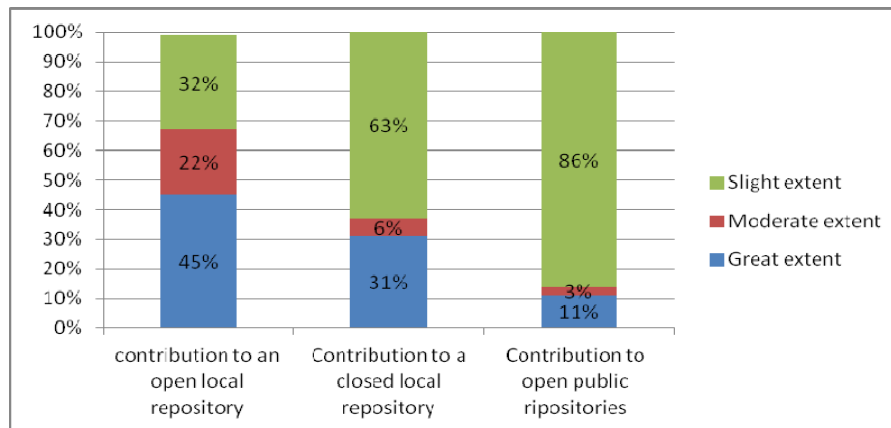


Figure 6. Contribution extent to the repositories (Slight, moderate and great extent)

In addition, 42% of the contributors reuse resources, distribute and share them with colleagues along with their experience in reusing them to a great extent, 14% of them share to a moderate extent, and 44% share to a slight extent (Figure 7).

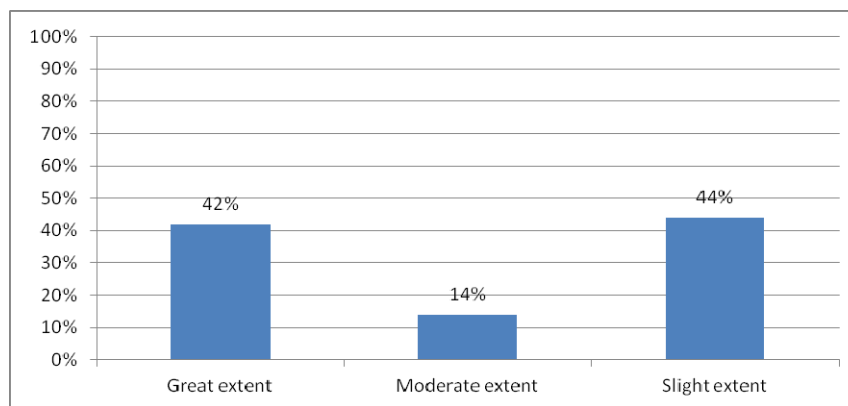


Figure 7. Reusing repositories resources and distributing to colleagues (Slight, moderate and great extent)

The types of materials that were contributed to the local repositories were examined as well (Figure 8). It was found that most of the contributed resources were office files of working pages, lesson plans, learning units, tests and exams (3.03), and administration files such as calendars of events and holidays, board exams, weekly programs and timetable (2.96). These resources were contributed by about 40% of the contributors to great extent. Furthermore contributors uploaded links to selected websites and repositories (2.79), online assignment (2.63) and links to online tools and applets (2.31), detailed description of curriculum and special programs (2.38) and students' works and outcomes (2.5).

The findings also revealed that the teachers' uploaded resources were usually derived from the general curriculum. However, unique resources related to special programs offered at the school were uploaded as well into the repositories, as were resources on Google Docs, videos, educational tasks, documentation of processes through images, presentations, and forms.

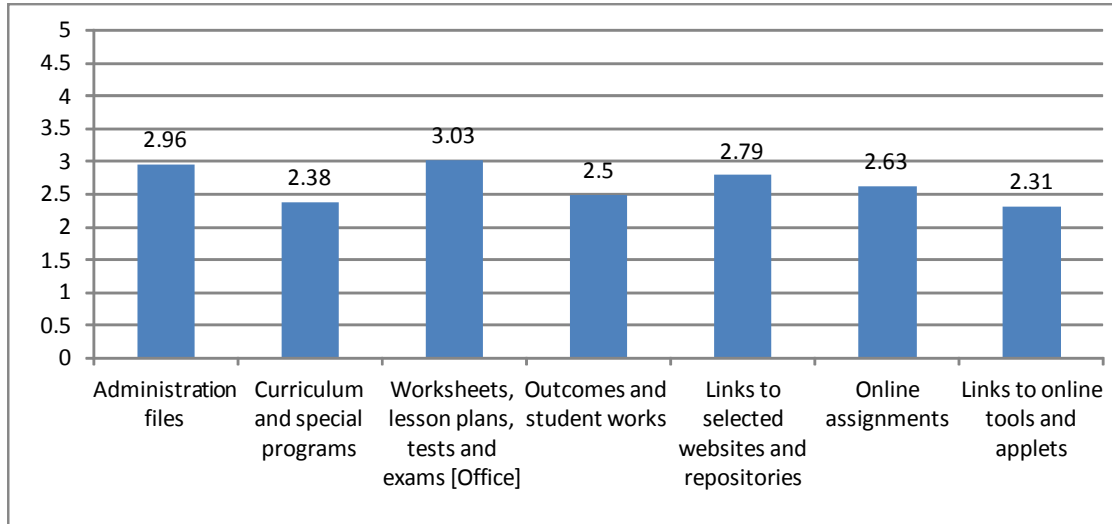


Figure 8. Types of materials contributed to local repositories (1= to a slight extent - 5= to a great extent)

To further understand whether differences exist among schools concerning the different kinds of contributed materials, we compared the contribution rate averages of the four schools. ANOVA test was performed to analyze the variance in the contribution extent of all material types in all four schools. The results of the variance analysis uncover significant differences among schools in repository use of all material types except for administrative resources, which were contributed and uploaded to all of the schools' repositories to a similar extent. In the fourth school, which does not have its own repository, the teachers uploaded these materials to the school website. Moreover, the extent of sharing of online learning materials among teachers in this fourth school was found to be very low. As for the other three schools, teachers were found to upload curricular materials and special learning programs to varying degrees, but without significant differences ($p > 0.5$).

However, regarding other material types, significant differences were found in the rates of contribution to local repositories among schools. Teachers in the second school, which implemented a closed repository that is accessible only to its own teachers, uploaded teaching materials such as working pages, lessons plans, and tests to the greatest extent. Teachers in the first school, which runs an embedded open repository, uploaded learning materials to a great extent as well. Teachers in the third school, which operates a closed repository uploaded learning materials to moderate extent ($p < 0.001$).

Teachers in the first school, which advocates a local open repository, reported the highest rates of posting links to learning sites and other repositories on the web; in contrast, teachers in the third school, which does not embed a local repository, reported the least posting of such links ($p < 0.001$). However, teachers in this third school uploaded student outcomes at a higher rate ($p < 0.005$), as well as online assignments and links to online tools ($p < 0.001$).

In analysis of the teacher surveys, the impact of teacher training on the extent of usage of the repositories materials was assessed. The findings indicate that 93% of the teachers received training in the past two years on ICT in education in general or on their specific discipline with a focus on integrating ICT. As expressed in Figure 9, 67% of the teachers indicated that continuing training exposed them to different repository materials available to them, 66% of the teachers indicated that the training supplied tools for integrating ICT into their teaching, and 61% indicated that they perceive a high correspondence between their training and their actual performance in class,

while 56% claimed that the training largely developed the ability to reuse materials in repositories, to evaluate them, or to construct teaching models. Moreover, only 34% of the teachers indicated that the training addressed the heterogeneity of the teachers’ knowledge and use of technology.

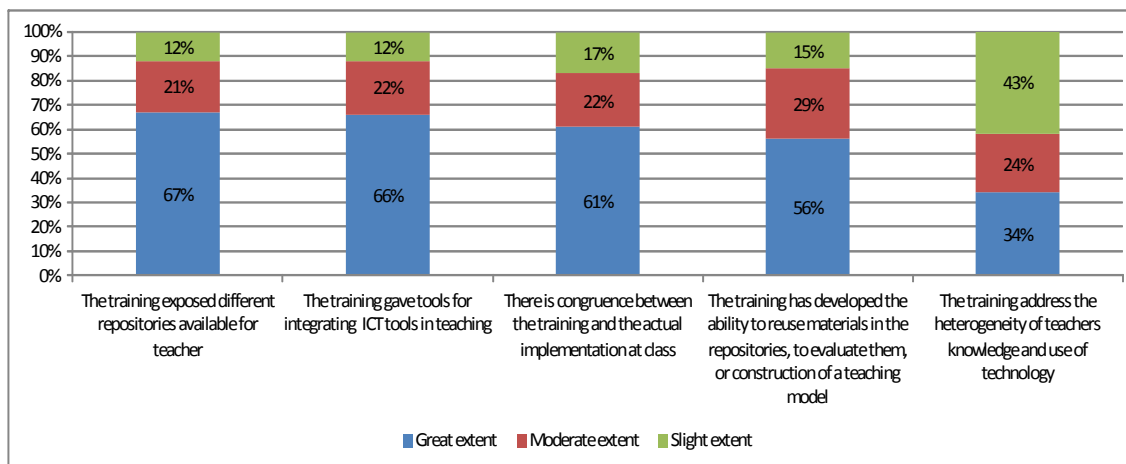


Figure 9. Teachers’ attitudes regarding the training program and its compatibility for repository usage (Slight, moderate and great extent)

The teachers’ training program was found to have the greatest contribution in the teachers’ activities in the online repository relative to other factors examined in every aspect: exposure to repositories; learning materials reuse and their evaluation; and the teachers’ contribution to these deposits. However, in the fourth school – which does not have a local repository – the training was less effective and the least successful in developing the ability to reuse materials in repositories, to evaluate them, or to construct instructional models. Yet no significant differences were found among schools regarding the training’s contribution to the reuse of repositories, except in regard to the teachers’ heterogeneity of technological knowledge ($p < .05$).

Examination of the correlations between the characteristics of the trainings and the teachers’ extent of use uncovered the following results (Table 1): moderate but significant correlations exist between the training concordance to the practice in class and the teachers’ contribution to the schools’ open websites ($R = .292$) but not to the local closed repositories or to public, open repositories. Furthermore, a moderate correlation was found between training and the practice and the reuse of repository resources by teachers as a basis to build lessons that they adjust for the students ($R = .334$) through a combination of different resources in the repository ($R = .237$) and by means of omitting irrelevant parts ($R = .397$). In addition, exposure to repositories in training correlates also to teachers’ contributions to the school website ($R = .286$), to their reuse in order to build customized lessons for students ($R = .266$), to combining resources ($R = .236$), and to omitting the irrelevant parts in specific resources ($R = .392$). When training developed capabilities to reuse and evaluate materials and construct instructional models, more teachers built customized lessons ($R = .240$) and contributed their products to the local closed site ($R = .226$) and to the school website ($R = .324$). Correlations of moderate intensity were found between the provision of technological tools in the training and the extent of use.

Examination of the training characteristics reveals higher significant correlations (Table 2). A very high correlation was found between the statement that the training corresponded with practice and the following: exposure to repositories ($R = .812$), development of capabilities ($R = .741$) and supply ICT tools ($R = .679$). Furthermore, exposure to repositories was highly corre-

lated with development of capabilities ($R=.656$) and supply of ICT tools ($R=.680$). Capabilities development correlated highly with the supply of ICT tools ($R=.714$).

Table 1: Correlations between the characteristics of the trainings and the extent of teachers' use of school repositories

	Contribution to the closed local repositories	Contribution to the school website	Contribution to open public repositories	Construction of customized lessons	Combination of different resources	Omitting irrelevant parts	Adding new relevant parts
Training concordance to practice	.19	.292**	.099	.334**	.237*	.397**	.099
Exposure to repositories	.16	.286**	.126	.266**	.236*	.392**	.011
Capability development	.226*	.324**	.115	.240*	.154	.175	.02
Addressing heterogeneity	.243*	.027	-.028	-.042	.088	.097	-.034
Supply ICT tools	.201*	.15	.089	.209*	.200*	.210*	-.019

* $P<.05$ ** $P<.01$

Table 2: Correlations between the characteristics of the trainings

	Training correspondence to practice	Exposure to repositories	Capability development	Addressing heterogeneity	Supply ICT tools
Training correspondence to practice	1	.812**	.741**	.320**	.679**
Exposure to repositories		1	.656**	.298**	.680**
Capability development			1	.442**	.714**

* $P<.05$ ** $P<.01$

Discussion

This study reveals that teachers use a variety of repositories across the Internet. Some are closed and some are open to the public free of charge; some are global, some are national and some are local – specific to the school itself and developed by the school's own teaching staff. Even in the case of a school that does not have a culture of use of its own internal repository, teachers make use of the school website as a local repository to share learning materials with colleagues or students. These findings indicate that teachers are aware of the potential of OER in online repositories and their possibilities for experiential learning that integrates knowledge, communication, and professional fulfillment through these repositories. However, they often prefer using local

repositories developed within their own schools to suit their learning environments and specific needs. The main reason for the vast use of the local repositories derives from the uniqueness of the materials that were uploaded and adapted to their needs. These materials were very much relevant and meaningful to the school teachers surveyed, since they were specifically adapted and could be controlled to fit the curriculum. Hence, teachers attributed great importance to these repositories, due to their time efficiency and contribution to the school knowledge management and the maintenance of this knowledge in the organizations.

The local repositories were found to be an integral part of the teaching and learning processes, serving the school's administrative and pedagogical needs. A local repository allows effective use of the organization's information resources; it creates a pool of experiences that is characterized by a common language; it provides initial response when searching for information; it presents internal standards (control process), enables professional development of teaching staff that use it, and it preserves organizational knowledge. Since the implementation of a local (school) repository is a significant and strategic transformation for an educational institution, it requires time to enable the teaching staff to acculturate to it (Ayalon et al., 2007). Moreover, teachers must be consistently and systematically guided and trained, helping them manage their knowledge and use of new skills so that this process can succeed.

In this study, different levels of reuse were identified based on Wiley's definitions (2009). Teachers reuse learning materials while they plan their lessons; they print tests and worksheets for students; they use online presentations, videos and music files in class; and they use interactive applications, visualizations, applets and simulations. Moreover, they construct adapted instructional units by means of varied resources from the repositories: through a combination of the different resources (REMIX), or by means of omission of irrelevant parts from the original resources or incorporation of new content, activities and assignments according to their specific aims and goals. The offline usage of the repository was found to be greater than its online usage. Offline, teachers still use a variety of teaching means, such as applets, simulations, and demonstrations aimed at summoning students to relevant, current, and challenging learning processes that facilitate the understanding of the material being taught. Specifically, teachers reported during the interviews that applets are not being used, mainly due to lack of equipment and appropriate technology infrastructure in the classrooms.

Combination of learning materials and incorporation of data to existing learning materials is relatively low. This finding is supported by Hilton et al. (2012), who argue that despite the potential and the many benefits offered by open educational resources, the reuse of these materials – including their unique combinations and re-adaptations for user needs – are relatively low. However, while Hilton et al. (2012) indicate a relatively low average contribution to the repositories, most of the teachers in this study claim to contribute materials to the repositories. This finding may result from the presence of local repositories and may indicate a significant effect of the local repositories on the teachers' engagement and contribution. Even in the fourth school, which does not maintain a local repository, the teachers uploaded these materials to the school website, referring to it as a local repository. Moreover, it was found that the extent of sharing of online learning materials among teachers in this fourth school was very low.

Most of the teachers who participated in this study attended training through seminars or courses on integrating ICT into education in varied disciplines in the last two years. They claim that they currently have broader technological knowledge, as the seminars and the continuing education programs strengthened their professional confidence; they feel more competent and less afraid of technologies. Furthermore, these seminars and the continuing education programs made school more enjoyable for the teacher and the students, since the lessons these teachers provide became more experiential. Some teachers also indicated a belief that in the future, they will see an improvement in student achievement as well. Many teachers mentioned that thanks to the seminars

and the continuing education programs, they learned to use the repositories, to locate materials for reuse and to add them to the local repositories and to organize the new information the repositories contain for the benefit of the community. Several teachers mentioned that over the course of their training, they learned how to integrate ICT into teaching programs and into their curricular construction, and that the benefits of technologies in education were sharpened. De Liddo (2010) suggests that one of the main barriers to the adoption of OERs involves people's lack of open thinking regarding this issue; it is interesting to explore whether the teachers who use local repository and are accompanied by training are actually "opening up" to OERs.

Teacher training and guidance is tremendously important in the process of implementation of OERs, even when they are stored in local repositories – in this case in schools. Training emphasizes exposure to various repositories, correspondence between the content of the workshop to the field, developing the skills and the abilities to reuse resources effectively for the construction of teaching models and assessment. Training is more effective when the repository is embedded within the school and when the school management is involved in the planning and training program. The finding of this study is consistent with Dressler and Sela's (2007) findings, which showed that investment in technology should also include teacher training in order to accomplish an effective use of technology according to specific pedagogical goals. It is very important that the training will be consistent with the activities in the field and practice, that teachers are exposed to different repositories, and that capabilities of reuse and evaluation be developed. Additionally, technological tools must be provided for the benefit of pedagogy.

Conclusions

This study explores teacher OER usage and training, with an emphasis on the examination of local (school) repositories and teacher contributions to them. It was revealed that a collaborative community is developing among teachers. This community not only reuses learning materials, it also contributes OER to local repositories affiliated with the schools, their goals and local curriculum, and is open to the general public. Moreover, this study uncovered that the use of these repositories does assist teachers with their pedagogical work. Continued research is planned to explore whether collaborations are emerging among schools located in the same city or municipal area. Furthermore, pedagogical practices of OER reuse in schools will be explored and expanded, aiming to understand the "new" instruction processes created by recurrent usage of several learning objects and to examine ways of distributing them to a broader population. The fact that teacher training had a significant impact on their activities, both in terms of reuse in different levels and contribution to the repositories for the benefit of the entire community, it is essential to continue to investigate the effectiveness of teacher training during the diffusion process. An emphasis will be put on exposure to various repositories, congruence between workshop content and discipline with response to the heterogeneity of the teachers, and developing the ability to reuse resources in the construction of new models for teaching and assessment.

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Appendix

The questionnaire [in Hebrew] included background information about the teachers, including their training, guidance, and information on how they use open repositories on the web and their schools' local repositories.

The questionnaire is available at [this link](#).

Biographies



Anat Cohen is a researcher and a lecturer in Tel-Aviv University's School of Education. Her Ph.D dissertation analysed the cost-effectiveness of Web-based Education, based on theoretical and computational models and empirical data using web-mining techniques. She participated in the IEA's Second International Technology in Education Study (SITES) and is currently a research and pedagogical coordinator of Virtual TAU - Web-Supported Academic Instruction in Tel-Aviv University. She has published over 40 research papers in leading peer-reviewed journals and conference proceedings. Her major research areas are: Cost-Effectiveness of Web-based Learning, Learning object repositories, Ubiquitous Learning, ICT implementation in Higher Education, Educational Data-Mining.



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