Abstract: This study examines the current state of ICT integration in teacher education in Israel, the policy of the Ministry of Education and colleges of education, the scope of ICT implementation by faculty members, and pre-service teacher preparation in using technology in teaching. The findings reveal that the ICT integration process is characterized by a top-down process of organizational change initiated by the Ministry of Education, but in the colleges, the process has not been led by systemic organizational change. Most faculty members implement basic ICT uses, while only few use technology to create change in their teaching methods. Most pre-service teachers enter college equipped with basic ICT skills as well as positive attitudes towards ICT integration in learning and teaching, but teacher training programs do not provide them with adequate skills and competencies to teach with technology in their classrooms. The dynamics of ICT integration in the last few years is characterized by a slow down, but changes are expected due to a new program of The Ministry of Education. The study is a part of interconnected studies on ICT in teacher education carried out by research network, initiated and sponsored by the Research Authority at the MOFET Institute, an intercollegiate center for professional development of teacher educators in Israel.

Introduction

E-society, E-education, E-generation, E-learning and other E-concepts reflect the new reality caused by rapid emergence of Information and Communication Technologies (ICT) in our lives. Taking into account the current and future needs of the e-generation, many countries try to reorganize their educational systems (P21, 2009; ASTC, 2009; Becta, 2010; Barell et al, 2010) defining the important abilities required in the 21st century: multiple literacies, expertise, innovation, critical thinking and problem solving. The Israeli Ministry of Education also plans the similar process.

Today’s students need educators who have the appropriate knowledge and skills to facilitate their involvement in e-learning culture (Bosco, 2009). In order to produce this type of teacher, it is necessary to transform schools of education into 21st century learning organizations staffed by educators who themselves manifest the characteristics of 21st century teachers (Carroll & Resta, 2010).

Pre-service teachers are expected to be ICT literate and updated in pedagogic innovations (ISTE, 2008; Webb & Downes, 2003). The training of pre-service teachers is complex and multifaceted. It requires time allocation, resources and a comprehensive pedagogical, technological and organizational support system (Allen & Seaman, 2005; Gomez, Sherin, Griesdorn & Finn, 2008; Granston, 2004; Moser, 2007). Best pedagogies may include components of accessible interactive technology, usage of updated data and information, collaboration and teamwork, peer-assessment – all enhanced by ICT-based applications (Bonk, 2009). Teacher educators play an

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important role in preparing pre-service teachers to teach in this way. However, the literature dealing with ICT implementation reports that a minority of faculty members implement ICT in their own teaching, due to a battery of barriers and obstacles, some of which are technology-based while others relate to organizational and personal difficulties (Goktas, Yildirim & Yildirim, 2009; Brzycki & Dudt, 2005). Surry, Ensminger & Jones (2003) studied the barriers to the integration of instructional technology in colleges of education and have developed a model of integration that describes seven factors facilitating the integration of technology: Resources, Infrastructure, People, Policies, Learning, Evaluation, and Support (the RIPPLES model). In order to provide these facilities, systemic changes are needed.

The change process in educational systems is different from change in other aspects of human endeavor. Changes in business and industry are regulated by the rules of the free market, whereas the educational system is mainly subsidized by a government, and is therefore affected by political change. Educational organizations cannot be changed without planned, top-down interventions. These interventions include the regulation of funding, curriculum shifts, the establishment of standards for output, and leadership in the macro (Ministry of Education), meso (colleges or schools) and micro (educators) levels (Kozma, 2003; Reigeluth & Duffy, 2008). Organizational change theories, when adapted to educational systems (CHANGE, 2003), outline clear recommendations for change agents (usually academic management) on how to implement organizational change through “a repetitive sequence of goal formulation, implementation, evaluation, and modification of goals based on what was learned or intended by the entity” (Van De Ven & Poole, 1995, p. 516).

The study is part of a interconnected studies on ICT in teacher education, carried out by research network initiated and sponsored by the Research Authority at the MOFET Institute, an intercollegiate center for professional development of teacher educators in Israel.

The Study

The study examines three aspects of ICT integration in teacher education in Israel: the policy of the Ministry of Education and of the colleges of education, the implementation of ICT by faculty members and the state of pre-service teacher preparation to teach using ICT. This study was conducted using mixed qualitative and quantitative research approaches. Research on policy issues was based on semi-structured interviews of 34 policy makers and academic management in the Ministry of Education and Colleges of Education as well as on the analysis of various official documents.

The implementation of ICT by faculty members was examined on the basis of four colleges of education in Israel having the reputation of being advanced in ICT integration. Data were collected using a questionnaire administered to 401 faculty members, and semi-structured interviews with academic management were held. The questionnaire was developed based on the RIPPLES model (Surry, Ensminger & Jones, 2003), the CBAM rubric (Hall & Hord, 1987) which was slightly modified for our research purposes and on a questionnaire used in similar research (Granston, 2004). The questionnaire included 25 questions (which comprised 138 items) that examined ICT implementation in teaching; faculty attitudes towards teaching with ICT; ICT skills; difficulties in adopting technology; and ICT uses for professional development. Additional data were related to pre-requisites necessary for ICT integration: ICT accessibility and technical, pedagogical and administrative support available in these institutions. The questionnaire was administered anonymously in the middle of the 2008-2009 academic year to all faculty members in four colleges of education firstly by putting hard copy in their personal mail boxes at the colleges, resulting in 196 respondents. The second step was an email request to fill out the online questionnaire which was sent to faculty members (if they hadn’t filled it out before) and this time another 205 respondents responded. The data were analyzed with SPSS software and included checking reliability, factor analysis, correlations and group characteristics comparisons. In order to evaluate the possible bias that might influence the sample, the use of course websites in the sample was compared to the use of course websites among all faculty members, as reflected in the college websites. A bias was found favoring the website users among the sample (50% vs. 33%). To solve this bias, a new sample was created so that it included all non-website-users and the percent of randomly chosen website users in accordance to their actual proportion in the population. This unbiased sample included 277 faculty members in four colleges of education. The second research tool - interviews with academic managers in four colleges - were focused on collecting information regarding their vision of the role of ICT in
teacher education, perception of the scope of ICT implementation by faculty, barriers and factors that may influence faculty’s willingness to use ICT in teaching, and the infrastructure and technical support in the colleges.

The preparation of the pre-service teachers to integrate ICT in teaching was evaluated by analyzing teacher training programs, a questionnaire administrated to 1,216 pre-service teachers as well as interviews with heads of ICT centers in four colleges of education in Israel. The questionnaire focused on the pre-service teachers’ attitudes towards integrating ICT in teaching and learning, their experience as learners being exposed to ICT-based pedagogical models in the general courses they study (as these models are reflected in ICT-based assignments), their experience in planning and teaching ICT based lessons, access to computers and the internet (at the colleges and at home) and access to technical support. The questionnaire included 15 questions which comprised 54 items and was administered at the end of 2008-2009 academic year using two formats: hard copy and online. The data was analyzed with SPSS software and included checking reliability, factor analysis, correlations and group characteristics comparisons. The interviews with the Heads of ICT Centers as well as academic administrators in four colleges were focused on collecting information regarding the curriculum programs for ICT-based teaching preparation and technical support available to students in the colleges.

The data collected in four colleges was combined with data gathered in eight other colleges through interviews with ICT center heads who completed the STaR Chart’s rubric developed by the CEO Forum for evaluating the state of ICT integration in colleges (CEO Forum on Education and Technology, 2000).

Findings

The research findings relate to three aspects of ICT integration in teacher education: the policy of the Ministry of Education and colleges of education, ICT implementation by faculty members, and pre-service teacher preparation for using technology in teaching.

The Policy of the ICT Integration in Teacher Education in Israel

The integration of computers in the educational system began in Israel about 30 years ago, but significant changes occurred from 1992 when a national ICT policy was declared by "The Committee for Computerizing the Education System" and whose implementation plan was established within the national project "Tomorrow ‘98" by the Committee of Science and Technology Education. ICT integration in teacher education colleges began as a top-down process initiated by The Department of Teacher Education in the Ministry of Education that led to, in the following years, a bottom-up process when innovative teachers who had participated in the national "Tomorrow ‘98" program initiated ICT-based projects with the support of The Department of Teacher Education and teacher colleges. The intercollegiate MOFET Institute played an important role in the diffusion of innovations within the teacher education settings, being a central node in the communication of innovative ideas and novel experiences to teacher educators.

Five major phases in this ICT integration process were identified. In the initial phase (1993-1996), the Israeli government and the Department of Teacher Education in the Ministry of Education initiated a wide-scale program of investments by setting up an infrastructure in the intercollegiate MOFET Institute and the colleges of education, as well as the training of the first cohorts of teacher educators which took place at the MOFET Institute. In the second phase (1996-1999), the integration process expanded to colleges where special efforts were focused on (a) developing computer literacy among teacher educators and pre-service teachers and (b) the support of technology-enhanced innovative projects. The third phase (1999-2003), was characterized by the support given to courseware development and distance education in teacher education colleges. In the fourth phase (2003-2007), ICT integration continued in the teacher education colleges and reached the stabilization stage. The Department of Teacher Education regulated the ICT integration process in the Colleges of Education through a funding policy, curriculum change, and the support of new initiatives. All teacher education colleges received funding for the specific purpose of technological infrastructure maintenance, development of web-based and online courses, pedagogical and technical support, maintenance of ICT support centers, and for purchasing services from the Intercollegiate Communications Center. This funding was carried out on a 1:1 matching basis and is goal-focused, meaning that the budget may be used by colleges solely for ICT integration. In the current fifth phase (2007-2010), the integration
process was characterized by slowing down, caused by overall shortcomings in the general budget of the Ministry of Education, organizational changes in the teacher education system (merging colleges) and the emergence of a new reform in teacher education programs (Ariav, 2008).

An analysis of the ICT integration process in light of the theory of organizational change shows that on the macro level (the Teacher Education Department in the Ministry of Education), the main stages of organizational change were promoted from the time of the declaration of the national vision up to its implementation by establishing the infrastructure, providing resources needed for implementation, developing a regulatory policy to oversee funding, initiating the professional development of teacher educators, adapting the curriculum to meet the needs of pre-service teachers, supporting innovative projects in the colleges and finally, evaluating the process. The final stages have yet to be accomplished: follow-up, establishing a new policy and standards for institutionalizing the change, establishing a plan for preserving the change and preventing homeostasis (a system’s tendency to return to a previous state due to lack of support of the change). According to current policy, the Department of Teacher Education is attempting to support a further growth of web-based and online courses in colleges by offering incentives to teachers who deliver these kinds of courses. However, 75% of teachers delivering online courses claimed they did not receive additional incentives. The reason for the mismatch of information is most likely due to the financial autonomy given to the colleges, i.e. the Department of Teacher Education in the Ministry of Education does not control the actual use of delivered funds, allowing college administrations to redistribute these funds for other ICT needs.

On the meso level (the colleges of education), despite the progress in ICT integration in the colleges, the process has not been led by systemic organizational change. Our findings show that although academic management within the Israeli teacher education colleges included ICT integration in their overall strategy, in most of the colleges this integration was not among their highest priorities; hence, actual programs of organizational change to facilitate ICT integration within their colleges have not been initiated. Other, more urgent issues (from the perspective of the college) required their attention (e.g., the academization process, budget shortcomings, organizational restructuring of the teacher education system). Another reason for the lack of organizational change is related to the attitudes of the academic leadership in most of the colleges towards the necessity of ICT integration in teacher education.

These findings assume that in order for ICT to effectively impact teacher education, it is necessary to establish clear goals and a detailed plan for their implementation on the college level.

**ICT Implementation by Faculty Members**

ICT implementation for teaching and professional needs by teacher educators was evaluated using different variables: kinds of ICT-based assignments integrated in teaching, use of course websites, ICT skills, attitudes, difficulties related to teaching with ICT, and participation in online professional activities. The results revealed that 80% of the teacher educator respondents integrated basic computerized tasks in their teaching (Internet search, email communication, and digital submission of assignments). Few of them (15%) integrated ICT in advanced ways, i.e., tasks that required authentic problem solving, inquiry, collaborative learning and using advanced Web 2 tools. One third of the sampled teacher educators integrated course sites in their teaching. A fifth of the respondents implemented elements of distance teaching (i.e. outclass activities), while 5% taught full distance learning classes. Less than a third of the teacher educators implemented assignments aimed to train pre-service teachers to integrate ICT in their field practice.

As for conditions needed for successful technology integration in teaching, such as ICT accessibility and technical, pedagogical and administrative support, most of the respondents found them basically available. The only exception concerned the lack of incentives for the increased workload needed for learning new skills and implementing technology in teaching. Interviews with the college academic management revealed that teacher educators who already integrate ICT in their practice participate in workshops and learn new tools and pedagogical approaches, while those, who are not ICT integrators, do not attend such workshops. We explain this finding based on Rogers’ diffusion of innovation theory (Rogers, 2003). According to this theory people differ in their ability to adopt innovations. Those who are more inclined to innovate adopt ICT skills earlier than those who are less inclined. Rogers divided the population into five categories, according to their willingness to adopt innovation, and represented this distribution as a bell-shaped, normal-distribution curve: Innovator (2.5 percent), Early Adopter (13.5 percent), Early Majority (34 percent), Late Majority (34 percent), and Laggards (16 percent). Our research
assumes that currently, the Innovators, the Early Adopters and only a part of the Early Majority among teacher educators have been involved in the process of ICT integration. In order to attract the rest of the teacher educators into the process, more planned efforts are required.

The Role of the MOFET Institute in Diffusion of Innovations

The MOFET Institute plays a unique role in the Israeli model of ICT integration in teacher education. It serves as an intercollegiate center for professional development of teacher educators from all colleges of education and provides a variety of frameworks that support teacher educators in their initiatives and in their research. Rogers (2003) emphasized the importance of communication channels in the process of diffusion of innovation in the community. Using the metaphor of a network, the MOFET Institute is the central hub that connects all of Israel's colleges of education, facilitating fast communication among them. Ten departments in the MOFET Institute are involved in ICT integration providing three basic services:

1. Professional development in general themes of teacher education using online channels,
2. Professional development focused on the integration of ICT in teaching and learning,
3. Technical support, learning management systems and online tools to colleges of education.

The Online Learning Environments Department provides courses, workshops, and webinars on the pedagogical aspects of ICT integration in teaching and learning. This department was also responsible for the organization of three international online teacher education conferences “Opening Gates in Teacher Education,” held in 2001, 2006 and 2010. The Forums Department enables faculty and administrators working in parallel leadership positions at colleges of education around the country to meet on a regular basis. One of these is the forum of Heads of ICT centers. Its members discuss common problems and share ideas and information. They exchange results about collaborative programs, research programs, position papers, workshops, and study days. The special interest group “Internet for practicum supervisors,” focuses on the ways ICT can be integrated into the supervision of student teachers’ field experiences. The Professional Division of MOFET offers a two-year course for specialization in ICT integration for teacher educators. The online academic journal “Kivunim” allows teacher educators to publish their papers using rich media tools. The MASA online portal delivers information about new publications and presentations in the general field of teacher education to teacher educators. The International Teacher Education Center (ITEC) is devoted to collaboration with the international community of teacher educators. The Communications Center provides various services for teacher education colleges. These include services as an internet provider, technical support, and the development of a Learning Management System. Recently the social networking website “Shluvim” was established allowing teacher educators to develop professional and social interactions with peers, creative writing and publishing teaching and learning materials.

Preparing Pre-Service Teachers to Use ICT in their Teaching Practice

The results indicate that, in general, most pre-service teachers entering colleges have basic ICT skills and positive attitudes towards ICT integration in education. Computers, Internet and technical support are available in the colleges and at home. Pre-service teachers are exposed to ICT integration in courses offered in colleges, but mostly to traditional methods, while innovative models of ICT integration, e.g. collaborative learning, inquiry, web-based synchronous and a-synchronous distance learning are rare. They have little experience in using Learning Management Systems and course websites; therefore, they are not sufficiently exposed to the advantages of learning management with technology. About half of the pre-service teachers graduate with no practical experience in ICT integration in teaching; others’ field experience is limited. The New Frameworks Program for Teacher Education implemented in Israel from 2006 emphasizes subject matter aspects in the teacher education curriculum, resulting in a vast decrease in ICT training courses. These findings lead to the conclusion that in the current state (2009-2010) teacher training programs do not provide pre-service teachers with adequate skills and competencies to teach with technology in classrooms.

Broadening the view to other colleges

The findings described in the previous sections concern the data collected in four teacher education colleges which are considered advanced in ICT integration. This sample is not representative but rather, is biased upward,
reflecting a better situation than the actual condition in the rest of the colleges. In order to get a more general picture, additional data were collected through semi-structured interviews with heads of ICT Centers at eight other colleges of education. These respondents together with the Heads of the ICT Centers at the four abovementioned colleges filled out a STaR Chart rubric designed by the CEO Forum (CEO, 2000). The rubric is based on self-evaluation of ICT integration in the colleges of education and includes a variety of categories: vision, infrastructure, funding, access to ICT resources, college administrators’ leadership, the faculty’s professional development, pedagogical uses of ICT, pre-service teacher training to teach with technology, and support and cooperation with schools. Within each category, four levels are defined: early, developing, advanced, and target.

The following results were found: in integrating ICT, half of the colleges are on the developing level and the other half on the advanced level. There are differences regarding academic leadership among the colleges. In more than half the colleges, the leaders do not cooperate in giving ICT top priority nor is there strategic planning or allocation of resources. In only three colleges, are the leaders directly involved in planning and funding ICT integration needs. Despite the differences in academic leadership, all the colleges make use of online resources and integrate ICT in teaching to some degree. As for the teaching staff: five colleges are at the early level of integrating technology and six colleges are at the developing level of technology integration. In addition, most colleges reported on courses integrating ICT but in all colleges the integration of ICT in pedagogical training is very limited. One would expect a higher level of technology integration considering that there are a variety of workshops for teaching staff focused on ICT.

Regarding the pre-service teachers: in most colleges, about 75% students make use of technology in their learning and work preparation, and are proficient in performing ICT-based tasks, while only half of them are skilled in using technology in their teaching.

Conclusions

This study examines the current state of ICT integration in Teacher Education in Israel: the policy of the Ministry of Education and colleges of education, the scope of ICT implementation by faculty members and pre-service teacher preparation in using technology in teaching. The current policy on the macro level tries to regulate a continuing ICT integration process in the colleges of education through goal-focused funding carried out on 1:1 matching. This policy was intended to maintain achievements gained by organizational change and to prevent homeostasis. However, the budget shortcomings over the last period and lack of control in the actual use of the funding and its follow-up within colleges weaken the policy’s effectiveness. These as well as systemic changes in Teacher Education caused a slowing down of the ICT integration process. Another reason for the slowing down relates to policy issues on the college level. Although college leaders included ICT integration in their overall strategy, this integration was generally not among their highest priorities, hence, actual programs of organizational change to facilitate ICT integration within their colleges have not been initiated.

As far as faculty is concerned, the findings reflect significant progress in ICT implementation in teaching by faculty in comparison to the previous decade: what was perceived then as innovative (using Office tools, online resources and email communication) is now routine practice. We found that most faculty members implement basic ICT uses, while only few use technology for innovative teaching methods. Faculty members are divided into two groups: self-motivated teachers who have already been involved in technology integration and those who are less involved in technology integration and need external sources for motivation. The lack of appropriate incentives for ICT-based teaching decreases the novice teacher’s motivation to adopt technological innovations.

Results also indicate that most pre-service teachers enter colleges equipped with basic ICT skills as well as positive attitudes towards ICT integration in learning and teaching, but teacher training programs do not expose them to innovative models and do not prepare them well enough to implement ICT in their teaching.

In light of these findings, it is necessary to take action on the following points:

- The establishment of clear goals for pre-service teacher education concerning the important ICT skills necessary to teach the e-generation,
- The redesign of the whole curriculum in accordance to these goals,
- The initiation of a planned organizational change process on the college level to achieve these goals,
The development of strategies to motivate and to involve all faculty members in ICT-based teaching,

The promotion of innovative pedagogical models best suited to the demands of the Information Age through collaborative efforts of teacher educators,

The provision of meaningful pedagogical, technological and administrative support for faculty and pre-service teachers.

Recently, the Israel Ministry of Education has established a new program focused on the development of 21st century skills emphasizing the role of ICT in education. Perhaps this will be the beginning of a new sixth phase in ICT integration in teacher education.

Using UNESCO’s Theoretical Framework for the evaluation of ICT Integration in educational systems, (UNESCO, 2009) it can be stated that Israeli Teacher Education has passed the “e-readiness” stage (infrastructure establishing and achieving the basic ICT literacy among faculty and pre-service teachers) and is moving on to the next “e-intensity” stage where the main efforts focus on developing innovative pedagogy, upgrading the curriculum, promoting organizational change and supporting the further professional development of teacher educators.

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