Integrating Technology in Teaching and Teacher Education: Implications for Policy and Curriculum Reform

Dr. Charalambos Vrasidas
Dr. Marina S. McIsaac

About the Authors

Dr. Charalambos Vrasidas is Coordinator of Research and Evaluation at the *Center for the Application of Information Technologies* and Visiting Assistant Professor at *Western Illinois University*. His research is focused on technology integration and online teacher education. (http://www.ucy.ac.cy/~vrasidas).
Address: Korakou, 2836, Nicosia – Cyprus. Email: vrasidas@cait.org.

Dr. Marina S. McIsaac is a professor at the department of *Educational Technology* at *Arizona State University*. Her research focuses on the applications of technology to education, particularly cross-cultural settings.
Address: Educational Technology, Arizona State University, Tempe, AZ 85287-0611, USA. Email: mmcisaac@asu.edu. (http://seamonkey.ed.asu.edu/~mcisaac)

Keywords

Technology integration, teacher preparation, reform, constructivism.

Vrasidas, C., McIsaac, M. (2001). Integrating technology in teaching and teacher education: Implications for policy and curriculum reform. Educational Media International, (38)2/3), 127-132.

Abstract

In this paper we discuss technology integration in teaching and teacher education. Emphasis is placed on policy and curriculum reform as they relate to the use of information technologies for teacher education. Particular reference is made to the situation in Cyprus public schools. We argue that for successful technology integration, there needs to be a shift in pedagogical approaches and reform of teacher education programs. Concluding, we provide suggestions on how information technologies can best be integrated in pre-service teacher education and in-service teacher professional development.

Introduction

Technology has invaded the workplace, our homes, and schools. In rich industrialized nations like the United States, computers and the Internet are abundant in schools and classrooms. According to the "Teachers' tools for the 21st century" survey, in 1999 almost all public school teachers (99 percent) reported having computers available somewhere in their schools and 84 percent of them reported having computers available in their classrooms (U.S. Department of Education, 2000a). Furthermore, there is a rapid increase in the proportion of schools that are connected to the Internet. In 1994 35 percent of US schools were online, compared to 95 percent in 1999 (U.S. Department of Education, 2000b). However, the situation regarding technology in schools is not the same in smaller countries such as Cyprus.

In 1997 the International Institute for Education Planning conducted an appraisal study of the Cyprus education system. The findings of that study set off a series of reforms in an effort to raise the quality of education offered by the public schools system. Among these innovations were the mixed ability classroom teaching, increased emphasis on cooperative learning, and technology integration into classroom teaching. The Cyprus Ministry of Education and Culture has recently announced plans to officially introduce computers and the Internet in public schools. Computer classes will be included into the upper levels of high school curriculum and computer skills will be taught as a separate subject matter. In primary schools the goal is to integrate technology into the various subject matters. Some of the major limitations of such innovations are budget constraints, lack of teacher training, and lengthy bureaucratic procedures.

Compared with other countries, Cyprus has one of the lowest funding rates per student. According to the International Institute for Educational Planning (1997), in primary education spending per student in US dollars was $1000 for Cyprus, $2290 for Spain, $2820 for Germany,

$3150 for France, $4750 for Denmark, and $5490 for USA. Educational innovations, like the introduction of computers and the internet in schools, require the generous financial support of the government for hardware and software acquisition as well as teacher training. In addition, the education system is very centralized in nature, thus proving to be inefficient in many aspects. For example, when primary schools collect the money themselves through parental support, the ministry will not allow them to get connected to the Internet easily. There is extensive and time-consuming paperwork to be completed for a school to be approved for Internet access. Such procedures might take longer than a whole academic year.

The introduction of computers in Cyprus primary schools has begun in September 1993 as a pilot project. The purpose of that project was to identify ways in which computers could be integrated in the curriculum as tools to support learning. The effort was coordinated by the newly formed Information Technology Team of the Curriculum Development unit at the Ministry of Education and Culture. From the 352 primary schools, only 48 have computer technology available, which corresponds to 13.6% of all public primary schools (Cyprus Ministry of Education and Culture, 2000). From the 48 schools that have computers, very few have access to the Internet.

The Pedagogical Institute, a training and development unit of the Ministry of Education and Culture, has begun a training effort to prepare primary school teachers on using computers in their teaching. According to the 1998 *Annual Education Report*, there are 3439 primary school teachers in action (Republic of Cyprus, 1998). However, between 1993 and 2000 only 600 teachers attended the computer preparation program. Although there are plans to expand the use of technology in schools, very little is discussed about the need to reform teacher training and

teacher preparation programs. We argue that it is important to address the need for both in-service and pre-service teacher training in order for technology innovations to succeed.

House (1979) argued that research on education and reform indicated that change could only happen at a large scale when is supported by the socio-historical and political milieu of a certain point in time. In addition, for educational innovations to succeed, they require the close collaboration of the teachers involved. History of education reform has shown that innovations have failed dramatically when teachers input was not incorporated and when teachers were not actively involved in the innovation (Means, 1994). Therefore, for successful integration of computers in primary schools, it is essential that the organized body of teachers participates in the decision making process, as well as in the design, implementation, and evaluation of programs relating to this innovation.

Technology has the potential to support curriculum and policy reform. However, reform efforts alone will not cause the necessary change. There is a reciprocal relation between reform and technology. As Means (1994) argued, technology drives reform in education, but also "education reform makes a school ripe for technology" (p. xii). In Cyprus, unfortunately, state education officials have the misconception that once technology is introduced in schools, reform will automatically take place. In addition to increased funding, what will facilitate technology integration in schools is reform of in-service professional development of teachers, reform of teacher preparation programs, and reform of pedagogical practices from teacher-centered to student-centered approaches.

The majority of teachers in Cyprus primary schools have not been prepared during their college years for integrating computers in their teaching. Therefore, there is a strong need for designing in-service professional development programs for these teachers. Buying computers

and software for schools and connecting them to the Internet does not automatically imply effective uses of technology. Estimates show that at least 30% of technology budgets should be devoted on teacher training and support (Web-Based Education Commission, 2000). The following discussion and suggestions for technology and reform apply for both pre-service teacher preparation and in-service teacher professional development.

Need for Pedagogical Shift

For successful technology integration in schools, teacher education programs play a crucial role. Teacher preparation on technologies should provide teachers with a solid understanding of the various media, their affordances, and their constraints. Such understandings can only emerge when teachers are actively involved in teaching and learning with technology across the various disciplines. The idea of teaching a separate course on computing skills, we believe is fundamentally flawed. The separate course approach is something used in teacher preparation programs and is also the approach followed to teach computers in Cyprus high-schools. Technology skills should not be taught out of context. One can best learn how to use a computer while working on a meaningful task. Teacher preparation should not be based on training for “computer literacy” but should prepare teachers for using technologies to construct, represent, and share knowledge in real life authentic contexts. Teachers should not be taught *about* technology but *how to use* technology for constructing, organizing, and communicating knowledge (Barron & Goldman, 1994). A long history of technology use in education shows that the first inclination is to use new technology in the same traditional ways as the old technology (Cuban, 1986; Means, 1994). Continuing old practices with new technology will neither change nor improve education. Old curricula and pedagogical approaches should be reformed, and if necessary replaced, to take advantage of the affordances of the new media.

Our conception of teaching and learning is based on a constructivist epistemology. According to constructivism, knowledge doesn't exist external to the learner. Rather, individual learners construct their own meanings based on their prior experiences (Vrasidas, in press). Learning is a result of construction, collaboration, reflection, and negotiation within a rich context in which learning is situated (Brown, Collins, & Duguid, 1989). Technology has the potential to support constructivist learning and be used for active, authentic, and cooperative activities (Jonassen, Peck, Wilson, 1999). Harasim (1996) argued that computer-mediated education facilitates educational approaches, which shift the focus from "knowledge transmission to knowledge building," (p. 205). Knowledge building results when learners interact with their peers, collaborate, discuss their ideas, form arguments, and negotiate meaning. When used appropriately, technology provides a more decentralized environment where students take more control of the learning environment and become active constructors of knowledge while working on authentic tasks. Information technologies and computer networks shift the role of the teacher from knowledge transmitter to that of a facilitator who provides opportunities for interaction and meaning making to all learners.

Technologies are not deliverers of content, but tools that educators and students use to construct knowledge and share meaning. The use of technology and cultural tools to communicate, exchange information, and construct knowledge is fundamental in constructivism. Strategies for teaching and learning are not chosen to facilitate transfer of knowledge from the world to the learner's head, but to provide tools the learner will use to create meaning. Teachers should therefore, be trained to use computers in ways that will allow their students to construct knowledge. Jonassen (1996) argued that technology-based learning occurs when students use computers as *mindtools* that enable them to represent what they know and organize their

knowledge in meaningful ways. Mindtools are tools that aid and extend the user's thinking capabilities and can be used for knowledge construction and problem solving. Some examples of mindtools include computer conferencing, databases, spreadsheets, and hypermedia development tools. Examples of projects that students can engage in using technology are building websites, creating databases, authoring multimedia programs, and developing interactive CD-ROMs. Such conceptions of technology-based teaching and learning should drive the reform efforts of teacher preparation and in-service teacher professional development.

If we adopt a constructivist approach to teacher education, evaluation practices need to be reformed as well. We cannot be teaching effectively following a student-centered constructivist approach and evaluate learning using solely standardized tests. Constructivist environments promote the creation of multiple perspectives within a variety of contexts. There is not *one correct* understanding and there is not *one correct* way of solving a problem. Students are encouraged to utilize multiple ways of solving instructional problems and justify their solutions. The creation of multiple perspectives and viewpoints calls for multiple assessment methods. Using portfolios and authentic assessment are evaluation methods appropriate to evaluate constructivist learning (Duffy & Cunningham, 1996; Jonassen, 1992). In addition, in a teacher education course, a variety of evaluation techniques can provide information about the learners' thinking processes, self-reflective skills, performance in completing real-world authentic tasks, and ability to identify technology solutions to instructional problems. Traditional tests can also be used but they should not be the only method of evaluation. Other evaluation techniques include the collection of students' projects and assignments, students' self-evaluations, reflective journals, and class presentations of sample lessons. When the teacher educator employs such

evaluation techniques, she also models for prospective teachers appropriate evaluation strategies of constructivist learning.

Teacher Preparation and Curriculum Reform

Technology should be an integral part of teacher preparation programs. Research shows that teachers tend to teach the way that they were taught (Ball, 1990, Lortie, 1975). Therefore, if we expect teachers to teach in a constructivist way using technology, we need to be teaching them in constructivist ways using technology. In a course on educational technology for teachers, the goal should not simply be to teach the use of several technology systems, their advantages, and disadvantages. Instead, the goal should be to provide students with opportunities to think like experts in making instructional decisions, selecting media for appropriate use, structuring learning activities, and employing sound pedagogical strategies in real-life contexts.

The instructor in a teacher preparation course should structure the learning environment so that she will have the opportunity to model expert behavior to students in sound uses of technology-based teaching and learning. It is important that the teacher educator is an expert in technology-based learning because only then she can model to her students—future teachers—expert behavior. Furthermore, teacher preparation programs should not simply offer a course in educational technology, but also demonstrate effective use of technology in teaching teachers several other courses. Constructivist uses of technology in teaching should be modeled in the teaching of other subject matters such as mathematics education, science education, and social studies. For example, during a course in science education, future teachers should be taught with technology in ways that model appropriate technology-based learning for science education.

There are numerous ways of integrating technology in teacher education since technology can provide a rich context for learning. Technology rich environments allow prospective teachers to experience real-life scenarios of classroom teaching, construct multiple perspectives, and reflect on their practice. Several rich interactive multimedia systems exist in the market that allow students to work in groups to review video vignettes of classroom teaching, identify good practices, and discuss them with their peers. At Arizona State University, the teacher preparation programs for both in-service and pre-service teacher training on mathematics methods, make extensive use of an interactive multimedia program called *Mathedology* (Technology Based Learning & Research, 1998). This professional development program blends pedagogical techniques and concepts with state of the art presentation and delivery mechanisms. Its main purpose is to improve the mathematical discourse abilities of primary teachers.

Mathedology is based on a digital library of classroom video depicting primary teachers teaching mathematical concepts using the National Council of Teachers of Mathematics' (NTCM) professional standards on discourse. The program includes video episodes of elementary mathematics teachers modeling the NCTM professional standards on discourse, expert commentary in audio format, content based on the NCTM Curriculum and Evaluation Standards, and animations of mathematical concepts. Students can view the video vignettes of teachers and discuss them with peers. *Mathedology* provides a rich context for teachers to develop an understanding of appropriate mathematics teaching in primary schools. Such multimedia systems provide all students and teacher a common and rich context for discussion, much richer than text descriptions of settings. In addition, students can listen to teachers shown in vignettes reflect on their practice and listen to what math educators and other experts have to say about the teaching strategies used in the video episodes.

Teacher Professional Development and Policy Reform

All the above suggestions can help reshape teacher preparation programs so that they can prepare teachers to integrate technology in teaching and learning. Curriculum, pedagogical, and policy changes are essential for the success of reform. To effectively integrate technology in teaching, pre-service teachers need to be well prepared, but also in-service teachers need to deepen their knowledge and skills as well. In-service teachers need time to develop, master, and reflect on technology-based learning approaches. They need time and incentives to participate in lifelong professional development. A study showed that 82% of US teachers cited the lack of release time as the most important barrier in using computers and the Internet in the classroom (US Department of Education, 2000b). From a policy perspective, it is important to allow teachers paid time to participate in professional development activities. In the US, 90% of all training in business and government settings takes place on paid time, whereas in US public schools only 39% of teacher training takes place on paid time (Web-Based Education Commission, 2000). In Cyprus, rarely are in-service teachers allowed to attend professional development seminars on paid time. Changing the teacher compensation structures and providing incentives can encourage teachers to participate in professional development activities throughout their careers and develop lifelong learning skills.

Another policy reform that can help promote professional development is to incorporate the completion of training attended to career ladder programs. Right now, the most important factor that influences ones opportunities for promotion in the Cyprus public education system is years of experience. This needs to change if we want to value and encourage up-to-date knowledge, skills, and qualifications. In addition, a skills-based or competency-based compensation pay system might be a better way to value and reward teacher knowledge and

skills. In such a system, teachers with more experience in the classroom and teachers who completed more professional development hours would get higher salaries. Such an approach can send the message to teachers that new skills are needed and valued, that the ministry is willing to compensate them for committing the time to improve their skills, and that for schools to continue educating our children, teachers need to develop life-long learning habits which will enhance their professional knowledge.

Conclusion

Changing the philosophical and pedagogical assumptions of education systems require time, effort, and strong political will. Programs developed need to be evaluated thoroughly to determine their effectiveness in preparing teachers to teach with technology. Skilled personnel are needed to develop, implement, and evaluate educational technology programs in teacher training. There is also a need for increased funding and strong determination of all parties involved. State officials, administrators, teachers, and parents should unite their efforts for the development of serious programs that will support education reform.

The issues briefly discussed in this paper are not only applicable to Cyprus but in other similar contexts as well. There are always obstacles to attempts for educational reform. The resistance to change that is deeply rooted in education systems and the fear of technology dominating our lives are forces that can withhold change. However, technology can help reform education and the education system needs to be reformed for successful technology integration. If we believe that teachers are the primary agents of change, then a good place to start is by reforming our teacher education programs to better prepare teachers take advantage of the affordances of the various technologies and successfully integrate them in their practice.

References

Ball, D. L. (1990). The mathematical understandings that prospective teachers bring to teacher education. The Elementary School Journal, 90(4), 449-466.

Barron, L. C., & Goldman, E. S. (1994). Integrating technology with teacher preparation. In B. Means (Ed.), Technology and Education Reform (pp. 57-81). San Francisco, CA: Jossey-Bass.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. Educational Researcher, 18, 32-42.

Cuban, L. (1986). Teachers and machines: The classroom uses of technology since 1920. New York: Teachers College Press.

Cyprus Ministry of Education and Culture (2000). The use of computers in primary education. Nicosia, Cyprus: Information Technology Team.

Duffy, T. M., & Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery of instruction. In D. H. Jonassen (Ed.), Handbook of Research for Educational Communications and Technology (pp. 170-198). New York: Simon & Shuster Macmillan.

Harasim, L. (1996). Online education: The future. In T. M. Harrison, & T. Stephen (Eds.), Computer networking and scholarly communication in the twenty-first-century university (pp. 203-214). New York: State University of New York Press.

House, E. R. (1979). Technology versus Craft: A ten-year perspective on innovation. Journal of Curriculum Studies, 11(1), 1-15.

International Institute for Educational Planning. (1997). Appraisal study of the Cyprus education system. Paris: UNESCO.

Jonassen, D. (1996). Computers in the classroom. Mindtools for critical thinking. Englewood Cliffs, NJ: Prentice-Hall.

Jonassen, D. H. (1992). Evaluating constructivistic learning. In T. M. Duffy, & D. H. Jonassen (Eds.), Constructivism and the technology of instruction (pp. 137-148). Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Jonassen, D. H., Peck, K. L., & Wilson, B. G. (1999). Learning with technology: A constructivist perspective. Upper Saddle River, NJ: Prentice-Hall.

Lortie, D. C. (1975). Schoolteacher: A sociological study. Chicago: University of Chicago Press.

Means, B., Ed. (1994). Technology and education reform. San Francisco, CA: Jossey-Bass.

Republic of Cyprus. (1998). Annual report on education 1998. Nicosia, Cyprus.

Technology Based Learning & Research (1998). Mathedology on CD-ROM. Tempe, AZ: Arizona State University.

U.S. Department of Education, National Center for Education Statistics (2000a). Teachers' Tools for the 21st Century. A Report on Teachers Use of Technology, Washington, DC: US Government Printing Office.

U.S. Department of Education, National Center for Educational Statistics (2000b). Internet Access in U.S. public schools and classrooms: 1994-1999. Washington DC: US Government Printing Office.

Vrasidas, C. (In press). Constructivism versus objectivism: Implications for interaction, course design, and evaluation in distance education. International Journal of Educational Telecommunications.

Web-Based Education Commission (2000). The power of the Internet for learning. Moving from promise to practice. Washington DC: US Government Printing Office.