

ICT-Related Teacher Professional Development: Models and Strategies

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It is clear that Information Communication Technologies (ICT) are increasing access to information, inspiring new developments in teaching, and allowing individuals and communities to interact any time. Although disputes over the value of using ICT in education is an obstacle to their adoption, the lack of availability of ICT in schools is another. Other obstacles include the realities and culture of the typical classroom and teachers' knowledge, skills, beliefs, and the lack of teacher professional development. (CEO Forum on Educational Technology, 2000; Cuban, 2001; Moursund & Bielefeldt, 1999; Vrasidas & Glass, 2005)

Education reform efforts have emphasized the importance of integrating ICT in the classroom and the need for quality teacher professional development to do so (Donnelly et al., 2002; McIntyre & Byrd, 1998). Pre-service teacher education programs are by no means sufficient to prepare teachers to be effective users of ICT in the classroom. As technology evolves rapidly, lessons learned even a few years earlier no longer suffice. Several scholars have argued that existing professional development programs are inadequate for preparing teachers for the 21st century (Ball & Cohen, 2000; Borko, 2004).

Successful technology integration in schools requires ICT as an integral part of *teacher preparation programs* (Duffield, 2005; Vrasidas & Glass, 2005). Teachers tend to teach as they were taught. If teachers are expected to teach using ICT, they should be taught by teacher educators who use ICT and who structure their courses so as to model expert ICT approaches in teaching. Pre-service teacher preparation programs should not simply offer one isolated course in educational technology; rather, they should

demonstrate sound use of ICTs in teaching teachers content and pedagogy. Partnerships between teacher education faculty and technology experts help faculty develop the expertise needed to act as role models for pre-service teachers.

Here we describe successful approaches to preparing teachers to teach with technology and to explicate a set of design suggestions culled from promising technology integration approaches. We discuss strategies and models of teacher professional development with an emphasis on programs designed to prepare in-service teachers to integrate ICT into their classrooms. The examples come from our work and the work of colleagues. For teacher professional development to succeed, educators must take a fresh look at curriculum, pedagogy, assessment, education policy, research, and evaluation. Teachers, administrators, policy makers, and other stakeholders should collaborate and participate in the decision making process, as well as in the design, implementation, and evaluation of professional development programs.

ICT-related Professional Development: Themes and Issues

Effective professional development for teachers has several characteristics that are common across various subjects (e.g., science education, math education): focusing on content, engaging teachers in active learning. However, there are some issues that are unique to ICT-related professional development.

Technology affordances for professional development

ICT affords access to knowledge and expertise that were previously unavailable, enabling new relationships and new models of professional development. The demands of work and family life for teachers, many of whom are women, underline the need for professional development activities that can be delivered any time, anywhere. Several

studies have shown that the blended approach of a combination of face-to-face workshops and online interaction can provide a sustainable model for ongoing teacher development (Clark, 2000; Vrasidas & Glass, 2004).

There are many barriers to effective participation in such initiatives. Many teachers have limited access to the Internet, which results in certain groups of teachers being disadvantaged and a greater gap between the “haves” and “have-nots” (Clark, 2000). Several skeptics question the use of online education because of access problems (Fabos & Young, 1999; Zembylas, Vrasidas, & Mclsaac, 2002). Some of this skepticism disappears when one takes an international view of online education. In many parts of the world, there can be no professional development without asynchronous online delivery because of the remoteness of the locations in which teachers practice, the cost of transportation, and the shortage of persons trained to conduct professional development. In many places, there is no practical alternative to online delivery of instruction (Vrasidas, Zembylas, & Glass, in press).

One of the main themes guiding the development of online professional development is that of *communities of practice* (Vrasidas & Glass, 2004; Wenger, 1999). The concept of community is fundamental to an understanding of how people learn and how professional development can take place online. Communities of practice are groups of individuals bound by what they do together—anything from engaging in informal discussions to solving problems—and by what they have learned through their mutual engagement in these activities. Thus, communities of practice are sites of mutual learning and important contributors to the success of knowledge-dependent organizations (Vrasidas & Zembylas, 2004). Such online communities provide both formal and informal professional development opportunities for teachers.

In the last decade or so, there has been increasing interest in constructing e-learning spaces to support communities of practice (Schlanger & Fusco, 2003; Schwen & Hara, 2003). Listservs®, bulletin boards, and course management systems can offer alternative methods of constructing communities of teachers that serve professional development needs. Dede, Whitehouse, and Brown L'Bahy (2002), for example, describe how ICTs are facilitating the development of virtual communities for creating, sharing, and mastering knowledge. An introductory course they designed to offer teachers a better understanding of ICT capabilities clearly illustrates the complexities of learning and teaching across distance and time.

Another example of a model for ICT-related professional development is illustrated in the program STAR-Online (Supporting Teachers with Anywhere/Anytime Resources <http://www.star-online.org>). STAR-Online is a model for continuing education and professional development for teachers that draws on the notion of communities of practice. More than 20,000 teachers have benefited through this project. Teachers can access mentors, colleagues, and resources via a web-based Virtual Teaching and Learning Community (VTLC) system, which provides interactive, self-paced, and collaborative development. The VTLC is an online model that allows teachers to develop knowledge and gain ICT skills in the application of educational technology. They develop lessons plans, share them with experts and peers, receive feedback, and comment on others' work.

Research has shown that teachers tend to teach as they were taught (Ball, 1990; Lortie, 1975). Teachers themselves have spent upwards of twenty years as students in elementary, secondary, and college classes. Consequently, their experiences as learners are often indelibly etched in their minds and shape their daily teaching. One of the advantages of ICT-related professional development is that it can support *reflection* in

ways that help teachers unlearn the old ways of thinking about teaching and learning. ICTs afford multiple kinds of interaction and the design of learning environments that support the development of communities of inquiry, collaboration, negotiation, and problem solving within authentic contexts. (Adelman, et al., 2002; Vrasidas & Glass, 2005). Removed from familiar surroundings and circumstances, teachers may be more willing to entertain alternative approaches to teaching.

ICT Professional Development Challenges

According to Donnelly, et al. (2002), studies have shown that teachers need three to six years of sustained practice to integrate ICT fully into the classroom. Adelman, et al. (2002) found that teachers identified time as the most significant barrier to integrating ICT in the classroom.

One of the most popular discussions in teacher professional development focuses on the importance of the successful integration of ICT into current curricula (Mumbi & Mesut, 2004). Access to quality digital content is crucial, and trying to develop one's own digital curricula is a task that very few teachers can be expected to undertake. However, it is not simply a matter of aligning the curriculum to new technologies. Technology has changed dramatically during the last few decades, but school curricula have not. Imposing innovative technologies on old curricula is a serious challenge. What we know about pedagogy requires that technology integration efforts be driven by the needs of education, rather than the business sector from which technological advancements typically arise. Trying to force the use of technology in the classroom when it was never designed for education often presents insuperable difficulties. ICT is always used within a context (e.g., to teach math, social studies, and the like), yet it always gets in the way since current ICTs used in the classroom are not transparent, generally added onto the

curriculum rather than integrated with it. Therefore, teachers and students often forced to focus more on the ICT tools they use rather than on the content of instruction.

Another difficulty stems from the reality that teachers are often asked to learn to use technological tools that become out-of-date with new development. Education software and applications can become obsolete quickly. Today, social networking software (e.g., Wikis, blogs, YouTube, and the like), mobile technologies (Blackberrys, cell phones, iPods), and games are popular among students, but the technologies and skills of ten years from now can not even be imagined today. Cyprus' Project HANDLEARN¹, which focuses on preparing teachers to use mobile technologies for environmental education, has struggled with choosing the most cost-effective mobile learning tools that will not be out of date before the end of the two-year project.

Finally, another unique characteristic of ICT-related professional development is the importance of infrastructure and technical support. In our experience in more than twenty countries, there are large discrepancies in the availability of ICT. We have encountered instances in the U.S. and Europe where every student in a classroom has a computer, whereas in certain countries in Africa and Asia, a school with more than 2,000 students has only a few dozen computers at their disposal (Vrasidas, Zembylas, & Glass, in press).

While a great deal of funding and sweat equity have been invested to improve teacher preparation programs and increase professional development opportunities, few visible uses of technology to meet educational goals are observed in either higher education or K-12 classrooms. We know relatively little about what constitutes *effective practice* for teaching teachers how to use technology. What follows are common themes and strategies that have emerged from a comprehensive review of the literature on

technology professional development. For each of these themes, we provide an illustration.

Strategies for Effective ICT Related Professional Development

We summarize in Table 1 the key issues and strategies for effective professional development. Education programs depend heavily on context, learners, and goals; therefore, program designers should carefully choose those strategies that best serve their needs.

Table 1. Key issues and strategies for ICT related professional development.

Key Issue	Strategy
Learning designs	Design programs based on what we know about how ICT can support learning
Authentic engagement within teacher's contexts	Situate programs in teachers' context so that activities are authentic.
Opportunities for reflection	Design activities that encourage participants to use ICT and reflect on their practice
Collaborative efforts	Encourage the use of ICT for collaboration among all stakeholders in the design, implementation, and evaluation of programs
Ongoing support	Use ICT and online technologies to provide ongoing support
Informal learning	Provide opportunities for informal learning and support
Systemic effort	Coordinate professional development with broader ICT and school improvement efforts
Leadership	Foster leadership which nurtures innovation, change, and the creation of schools as learning organizations

Learning designs. Students learn best when they are actively engaged in meaningful activities, collaborate with peers, exchange ideas, provide and receive peer feedback, reflect critically on what they are doing, work on real-world, challenging, authentic activities, and when their work is constantly evaluated and they are intrinsically

motivated (Bransford, Brown, & Cocking, 1999). But it is easily forgotten that teachers/adults learn best in the same ways (Putnam & Borko, 2000). Good professional development for teachers will resemble the best teaching for all learners (Gross, et al., 2001; Vrasidas & Glass, 2005).

Authentic engagement. Effective professional development is situated in teachers' everyday practice, and distributed across communities, tools, and contexts. As such, it provides authentic opportunities for teachers to think like experts in making instructional decisions, structuring learning activities, and employing sound pedagogical strategies. One such example is project ENVETI², a teacher professional development program developed by the Centre for the Advancement of Research and Development in Educational Technology (CARDET) and implemented in Cyprus. Professional development experiences provide participants with a clear view of the connections between what they are learning and their classroom practice. Project ENVETI emphasizes two critical areas: environmental education and technology integration. The use of ICT creates new opportunities for Cypriot teachers to enrich their pedagogical knowledge of how to deal with health and environmental issues that affect Cyprus and the Mediterranean basin (Vrasidas et al., 2007). Experts from local universities and research centers establish partnerships with local teachers and schools and develop curricula that integrate technology in environmental education and at the same time promote multiculturalism and peace. Teachers work in teams to identify specific thematic units aligned with local curricula. These units serve as the focus of the professional development program. Following the identification of the content, training is offered (face-to-face and online) to a core group of teachers who in turn serve as trainers to teachers at their local schools. Teachers collaborate with experts and they share and discuss their

findings online and face-to-face. They then develop lesson plans on environmental education that will be implemented in their classrooms.

In programs we developed for teachers in Europe, the U.S., and Asia-Pacific, we worked with local stakeholders, evaluated the ICT infrastructure, conducted a needs assessment, and developed material with the help of local teachers and experts, ensuring the alignment of professional development with local curricula, cultures, and contexts. In projects TECHNOSKEPSI², HANDLEARN, and ENVETI teachers are taught how to integrate online technologies and web-based tools in their teaching by participating in workshops that are offered face-to-face and supported within an online learning environment. Thus, they actually participate and moderate online discussions similar to those they are asked to develop for their students. Teachers are provided with opportunities to interact with experts and peers as they develop and implement lesson plans integrating ICT into their classrooms.

Reflection. Teachers need time to develop, master, and reflect on technology-based learning approaches. They need to be given ample opportunities to engage in meaningful activities, collaborate with peers, exchange ideas, provide feedback to peers and receive feedback from them, reflect critically on their work, and engage in real-world, challenging, and authentic activities (Chitpin & Evers, 2005). It is essential that professional development policies be established that promote technology integration and provide incentives to encourage teachers to engage in lifelong learning. Using web-based portfolios can be a valuable tool that will allow teachers to document their knowledge and reflect on their practice. In projects we developed and implemented, teachers were required to develop lessons plans, implement them, and then reflect on them using an online portal (for example, see <http://www.enveti.org>).

Another program that supports reflection was designed by Riel, DeWindt, Chase, and Askegreen (2005), who employed multiple strategies for fostering teacher learning with technology and presented several approaches to professional development for promoting attitudes, aptitudes, and practices supporting an ongoing process of inquiry and learning. Each approach depicts teacher learning as a process that is directed by the learner, socially constructed, and continuous. One such approach focuses on the use of a mentor who works with student teachers in planning and implementing action research projects prepared to help teachers integrate ICT into their classroom. Reflection on practice and revision of plans are fundamental characteristics of such models.

Collaborative efforts. One of the key characteristics of successful professional development programs is collaboration among all stakeholders (Gross, Truesdale, & Bielec, 2001; Manke, Ward, Lundeberg, & Tikoo, 2005; Vrasidas & Glass, 2005). Collaborative efforts among in-service and pre-service teachers, university faculty, technology experts, and policymakers will ensure the commitment needed for the success of professional development programs. The participatory nature of collaborative projects provides for a shared ownership and understanding of the project among all participants. Innovative professional development involves opportunities for teachers to share their expertise, learn from peers, and collaborate on real-life projects. Teachers' needs are better served when they are able to make connections between their daily work and professional development (Darling-Hammond & McLaughlin, 1995). Radinsky, Smolin, and Lawless (2005) reported a case study of the construction of a professional development program in which teacher education faculty, technology experts, and teachers collaborated to design modules integrating ICT into the curriculum. This collaborative curriculum design anchored the process of learning to use ICT in an exploration of what it meant to teach and learn the subject. For example, students learn

to create web-based hypertext documents in order to support historical arguments that are built upon primary source documents.

In Teaching and Learning Online (TLO), a teacher professional development initiative designed to prepare Illinois teachers to use technology and teach online classes, administrators from school districts, teachers, and experts from academia collaborated on the design, implementation, and evaluation of the program (Vrasidas & Chamberlain, 2005). Collaboration on this project took place at several levels. First, a needs assessment was conducted. Then schools and school districts in the state of Illinois collaborated with each other in the development of curricula designed to meet some of the needs and to facilitate coordination of the project. All stakeholders in the project wanted to empower teachers to use ICT successfully to develop and teach online classes. Once the project entered its development stages, schoolteachers and school administrators collaborated with the design team in developing the classes. Expert teachers served as trainers for colleagues in their schools and received ongoing support throughout the stages of the project. Educational technologists and experts worked with teachers and schools to establish the program policies. Findings from project evaluations revealed that one of the core strengths of the program was the close collaboration among all stakeholders. This is another example of a professional development program where multiple “models” have been applied: train the trainer, school-to-school partnership, curriculum development, and the university-schools partnership.

Another approach illustrating the importance of collaboration comes from a project by Thompson, Schmidt, and Davis (2003), which used Goodlad's (1994) model for simultaneous renewal as its foundation. Goodlad argued that for successful school renewal, both schools and teacher preparation programs should collaborate in simultaneous reform efforts. Thompson and colleagues developed a project that brought

together K-6 in-service teachers, pre-service teachers, and university faculty to share resources and expertise with the goal of integrating ICT in the classroom and improving teaching and learning. Preliminary evaluation showed that the project was successful in demonstrating effective simultaneous renewal, and that it changed attitudes and practices among teachers and university faculty.

Collaboration can take place at many levels. At one level, collaboration takes place between schools and universities. Through such partnerships, expert teacher educators collaborate with teachers in developing and implementing programs that serve the teachers' needs (Smolin, Lawless, & Radinsky, 2005). Good partnerships between universities and schools are essential for the success of education initiatives such as ENVETI, TLO, and STAR-Online. All partners worked closely to develop the material, train the teachers, and implement the programs, and to bring solid theoretical and research grounding that helped shape the development, implementation, and evaluation of these programs. Schools and teachers contributed the real-world view of teacher needs and a more pragmatic approach to their development. Furthermore, collaboration within the same school or among schools allowed teachers to learn from their peers and exchange ideas. Collaborative projects allowed teachers to have access to each other's expertise and increased the sense of interdependence among participants. This collaboration often took place online via the project portals.

Ongoing support. One of the major criticisms of professional development programs is that they often take the form of a one-shot three-hour workshop with no follow-up activities. Teacher support should not be based on such models; it must be ongoing and embedded. Projects like STAR-Online, and ENVETI provide teachers the ongoing support and resources they need to integrate ICT in their classroom. Follow-up activities are structured to ensure that professional development makes a difference.

Teachers participate in face-to-face and online workshops and at the same time receive ongoing support via an online portal. This portal provides teachers with resources, support, and opportunities to share and discuss lessons and activities with peers and exchange resources with other teachers. Such blended models of professional development can better serve the needs of today's teachers.

Informal learning. A significant amount of professional development takes place informally. Researchers are only just beginning to explore the ways in which informal learning affects teacher technology use in the classroom. Teachers often engage in informal learning activities during which they explore their own research interests, learn with family and friends, chat with colleagues online or in person, and post questions on discussion forums (Adelman et al., 2002). These opportunities are at least as important as formal ones, and develop knowledge and ICT skills. Adelman et al. found that 78% of teachers reported that they participated in informal ICT-related activities, and that the effects of both formal and informal learning were similar in nature and strength. Given the fact that a large number of teachers indicate that this "informal professional development" has contributed to their use of technology in the classroom, it seems useful to support opportunities that allow for informal professional development to take place. One simple way of doing so would be to provide, within online portals, areas where unstructured interactions can take place among teachers. Another way would be to encourage teachers to maintain their own blogs, sharing their experiences using ICT, that can be read and commented on.

Systemic effort. Teacher professional development to integrate ICT into the classroom needs to be systemic, which will necessitate addressing some obstacles, as already noted. These include the school culture's traditional resistance to change; the lack of ICT infrastructure, teacher technology skills, appropriate and accessible

technologies, and teacher support; curriculum constraints; education policy which mandates technology use but provides little in the way of guidelines and funding, and assessment problems. ICT-related professional development programs are rarely coordinated or integrated with systemic education reform efforts.

Meaningful systemic efforts at school improvement place an emphasis on lifelong learning, and presumably schools aim to develop autonomous learners by developing lifelong learning skills and competencies in their students. For this to occur consistently, schools have to change from institutions that “transfer” knowledge into true learning organizations (Coppeters, 2005). A learning organization is one that has the capacity to learn, change, and adapt to rapidly changing contexts (Argyris, 1999). When schools become learning organizations, they embrace change and innovation and nurture lifelong learning for both teachers and students. ICT is a tool that allows both teachers and students to become and remain lifelong learners. One of the most important skills that a person must now have is the ability to learn online--skills like searching for information, critically evaluating such information, and using it to solve specific problems will be essential for both teachers and students. ICT can be instrumental, indeed it might be the key instrument, in turning schools into learning organizations.

Leadership. Strong leadership commitments from schools and colleges of education to the integration of ICT and professional development can help establish the conditions and the support teachers need to succeed. Leadership must emphasize lifelong learning and the transformation of schools into learning organizations within which all members are engaged in learning and leading. Leading, like learning, is shared and distributed among all members of the community (Spillane, 2006). In terms of professional development, distributed leadership supports and values teachers' agency in driving educational change. In projects we developed and implemented in Asia, for

example, special workshops were offered to administrators to help them better understand the value of ICT, the complexities in integrating ICT in the classroom, and the support teachers need to flourish—critical understandings in fostering distributed leadership for technology use in their schools.

Conclusion

In this chapter, we have shared strategies and models of teacher professional development aimed at integrating ICT into classroom teaching. Several of these strategies can be applied to a variety of professional development contexts other than ICT. We have presented a number of ideas, strategies, and models that cover design issues, the importance of shared ownership and vision, a systemic approach to teacher development, and the collaborative nature of successful professional development projects. While we have identified a number of influences affecting successful professional development programs, more research is required to understand the complexities of teachers' practices and how professional development can help teachers better serve their students' needs.

There are several lines of research related to preparing teachers to teach with technology that teacher educators can pursue. These include:

- What technologies can be used to undertake the kinds of tasks that teachers cannot easily perform, making room for teachers to focus on the tasks they do best?
- How has technology made some professional development content obsolete and other content more important than ever?
- What professional development content should be relegated to machines instead of taught to humans?

- What combination of technologies, content, context, and instructional methods are appropriate for what kinds of instructional goals, teachers, and learners?
- What changes need to be made in our current teacher education programs to better facilitate technology use in schools?
- How can in-service teachers be re-trained so that they integrate technology for teaching, learning and assessment?
- What is the role of informal learning and how can we foster informal learning to facilitate teacher professional development?

Notes

1. Project HANDLEARN is run by CARDET and supported by the Cyprus Research Promotion Foundation.

2. ENVETI is supported by the United Nations Development Program, Action for Cooperation and Trust (UNDP-ACT), which receives support from the American people through a grant from USAID. The views expressed in this publication are those of the authors and do not necessarily represent those of the United Nations or its Member States, UNDP or USAID.

3. Project TECHNOSKEPSI is run by CARDET and supported by the Cyprus Research Promotion Foundation.

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