

Policy Issues and Challenges in Planning and Implementing e-Learning in Teacher Education

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'In Nigeria, over 50 million school-age children are undereducated. Only a handful of youths have used computers or know how to apply technology tools in their daily lives for learning and improving their communities. A few schools have one or two computers that are often not used because they are outdated or the teachers lack the adequate skills to utilize them. Traditional teaching methodologies of a black board and four walls are not well suited in this area of education as they tend to be too far removed from practical reality to effectively instill the requisite technology skills and understanding. In addition, technology training and courses are not part of the educational curriculum in the 'early-adopter' stages of primary and secondary school levels, when youth are more likely to take an interest in learning new technologies.'

Njideka Ugwuegbu, 2002

This chapter examines the policy issues and challenges in planning and implementing e-learning in teacher education. The most significant issue is that implementing e-learning requires organizational and attitudinal change; in other words, e-learning requires the understanding and support of a wide range of stakeholders if it is to be successfully implemented. This chapter looks at why e-learning requires organizational and attitudinal change, and suggests some strategies for bringing about such change.

National commitment to participate in a knowledge-based global society

For both social and economic reasons, all students will need computer and communications technology skills if they are to live successfully in a knowledge-based society. Indeed, it could be argued that skill in using computer and communications technologies will be as fundamental to education in the 21st century as was literacy and numeracy in the 20th century.

Bates (2001. p. 24) states that:

'Knowledge-based economies are those dependent on hi-tech sectors such as computing, telecommunications, and biotechnology, and service industries, such as financial services, health, education, entertainment, hospitality and tourism. Such industries or employment sectors require a highly flexible and adaptable work force that can continually change as the knowledge-base and the external world changes around them. Thus the new knowledge-based organizations require not only technology skilled workers with up-to-date and recent knowledge, but also workers who are constantly learning, in order for commercial companies to survive, or for public organizations to stay current and effective.

These changes in the work force and the demand for more flexibility from students and employers directly influence the kind of learning and hence the kind of teaching now increasingly in demand from both students and employers in knowledge-based economies. The Conference Board of Canada has summarized well these skills (1991):

- good communication skills (reading/writing/speaking/listening)
- ability to learn independently
- social skills: ethics; positive attitudes; responsibility
- teamwork
- ability to adapt to changing circumstances
- thinking skills: problem-solving; critical/logical/ numerical thinking
- knowledge navigation: where to get/how to process information.'

The economic argument for developing skills in computer and communications technologies has been expressed as follows by Akst and Jensen (2001) of the Carnegie Foundation:

'Communities with the tools and skills to compete in the digital economy are at a distinct advantage over communities that don't. In many ways, the situation in a given community can build upon itself, for better or for worse. A community with a well-educated, technology-literate population is more likely to attract and sustain new businesses, and these new businesses in turn attract more well-educated, technology-literate people into the area. Conversely, a community that lacks reliable access to technology and the skills to use it is less likely to attract and sustain new businesses that could potentially serve as a catalyst to economic prosperity. Simply put, if communities are to remain competitive in attracting, retaining and developing businesses in today's economy, they must develop modern telecommunications facilities and cultivate a well-trained workforce to stay viable.'

<http://www.digitaldividenetwork.org/content/stories/index.cfm?key=158>

Secondly, it is not just in the workplace that these skills are needed. Increased access to mobile phones, computers and the Internet, particularly among young people, is leading to strong changes in social and cultural behaviour. The impact of mobile phone text messaging on the outcomes of national elections in Spain and Korea in 2004 provides dramatic examples of how young people are using new technology to impact on the political process. Less dramatically, more and more people are using the Internet to book accommodation, rail or bus tickets, and to send messages. At the same time, it is becoming increasingly important to know where to find information, how to compare or integrate different sources of information, how to determine the reliability and validity of information collected, and how best to use and communicate such information. Thus in a knowledge-based economy, students need to learn how to use technology to seek, organize, analyze and apply information appropriately.

Teachers then will also need these skills themselves, if they are to help their students. Currently, not all teachers nor even all parents share the view that teachers and students need high levels of skills in using computers and communications technologies (although most students take this for granted). Therefore governments face a battle for the hearts and minds of both teachers and parents.

The most commonly expressed fear is that technology will replace teachers, and this is an issue that has been pushed hard by some teachers' unions to resist the introduction of technology into the classroom. However, despite the rapid growth of distance education, it has become clear from experience over the last twenty years that technology does not replace teachers in the classroom.

Through distance education, technology provides access to new educational markets (thus increasing the demand for teachers) and within the classroom, technology enables a wider range of teaching possibilities. The emphasis in using technology in the classroom is primarily to increase access to information and communication beyond the classroom. Technology will only replace teachers where the emphasis is on content, not process, but the demands of a knowledge-based society are primarily process-focused - finding, analyzing and applying information, rather than transmitting information in an unprocessed manner. Nevertheless, without clear commitments by government and educational employers that technology will not replace the need for teachers, backed up by facts and figures about plans for teacher recruitment and class-sizes, there will be resistance to the use of technology.

More fundamentally, there is a generational conflict with respect to technology, particularly where the teaching workforce is on average relatively old. Students often are more comfortable, knowledgeable, and skilled in the technical operation of computers, mobile phones, and portable digital appliances (PDAs). This places many teachers at a strong disadvantage when it comes to using technology in the classroom. Fear and loss of status is a major barrier to persuading teachers of the value of technology, both for teaching, and for developing the necessary technology skills in their students. On the other hand, younger teachers may be more sympathetic to the use of technology in school, as they are more likely to have access to computers and the Internet at home and to use it for class preparation, than more experienced teachers, according to data from the United States' National Center for Education Statistics (<http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000102>)

But why do teachers need to prepare students for the use of technology if the students are already more skilled than the teachers? The problem is that without proper supervision and training, the skills that students develop for themselves are often narrowly focused. The skills that children learn autonomously tend to be technical rather than value-driven (or rather, driven by the values of children rather than of adults, such as game-playing, chat, and access to the web sites of pop stars). The role of the teacher is to help students use technology with discrimination, exercising judgement as well as technical skill. In particular, teachers need to help students learn to use technology to improve their academic and social skills. Furthermore not all students develop technology skills autonomously or to equal levels of skill. In particular, there tends to be an equity issue. Since home ownership of computers is strongly correlated with income, it is likely to be the children of the more wealthy that will learn computing skills without the intervention of the education system.

There is a strong role for government in getting across the message to teachers and parents that not only will jobs be different from those in the past, but the skills that are needed in the workforce will also be different. For instance, it is difficult for parents who have worked mainly in agricultural or industrial organizations to understand the importance of good communications skills, decision-making skills, and entrepreneurship that will be needed in a knowledge-based society. Such attitudes can be reflected in a demand for a return to the 'core curriculum' of reading, writing and arithmetic, at the expense of 'peripheral' activities such as using computers in a classroom. The more traditional the society, the more resistance there will be to new teaching methods that try to develop the skills of knowledge navigation, critical thinking, and decision-making, rather than an emphasis on transmission of information and rote learning.

Lastly, many teachers will not be resistant in principle to the greater use of technology in the classroom, but recognize that they need adequate training and the resources (such as an adequate number of computers and high-speed Internet access) if they are to use technology properly to support their teaching.

Thus an important role for government and for others responsible for the training of teachers is to ensure that teacher training, and especially teaching methods, are aligned with the future needs

of its citizens. Communicating the reasons for any changes in teaching methods, including the use of technology in the classroom, to parents and teachers is a major responsibility of government. Without such understanding, resistance to new teaching methods will come from both parents and teachers. Without specific actions to develop the necessary skills for teachers in using technology, and specifically in how to use technology to prepare students for a knowledge-based society, teachers will continue to resist pressure to use technology more extensively and appropriately within the classroom. One way to help teachers overcome their fears about technology will be to make technology a part of their training about technology. E-learning is an ideal way to achieve this end. However, using e-learning for teacher education without locating it within a wider understanding of the importance of technology-based teaching will be more difficult, although not impossible.

Existing infrastructure and state of readiness to implement e-learning

Before a plan or strategy can be developed for e-learning in teacher training, it is important to understand the necessary conditions or requirements for the successful implementation of e-learning. A major requirement is to ensure that the programs can be delivered to the targeted teachers. This will depend on four factors: the location of the teachers to be trained; the available technology infrastructure needed to reach the targeted teachers; the availability of appropriate human support staff; and ongoing funding to ensure that the necessary infrastructure is sustained and maintained.

Reaching the teachers

Pre-service teachers.

The easier target group to reach is pre-service teachers being trained in conventional institutions such as a university or college. The ability to reach such teachers with e-learning will depend on two factors: the network and computer infrastructure on campus; and the external, national Internet infrastructure. E-learning could be used to allow pre-service teachers to attend a local college where some form of supervision can be provided (perhaps by local but experienced teachers), while the teacher training experts are located at a more distant university or college. Alternatively, a university or college with a pre-service teacher training program could use e-learning to bring in additional resources and expertise, or even connect trainee teachers to real online teaching with students off-campus.

In both cases, though, the local institution must have sufficient computers connected to the Internet for all trainee teachers, supervisors and experts engaged in the program. The local institution must also have the local area network capacity to support such a program. It cannot always be assumed that local institutions will have either the local capacity, or the necessary links to the Internet, to cope with a new program. Creating a new program based on e-learning then is likely to involve some local start-up equipment and network costs. Furthermore, users may need to be trained in how to use the equipment.

In-service teachers.

The more difficult target group to reach will be in-service teachers. In-service teachers may access e-learning in at least three different ways. They may access programs from home, if they have a computer and Internet access at home. In developed countries, most teachers are likely to have Internet access at home. According to the U.S. National Center for Education Statistics, in 1999, eighty-two percent of public school teachers reported having a computer available at home, and 63 percent of public school teachers had the Internet available at home (<http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000102>). This is not likely to be the case in many developing countries, although it is always useful to track home access to the Internet, as it can change very quickly, especially among professionals such as teachers.

In-service teachers may be able to access programs through their own school, if the school has Internet access. This may not always be convenient though. There may for instance be only one computer connected to the Internet, and that is in the office of the principal or head teacher. Other computers may be available only when a school is closed and the children have gone home. In general, the poorer the community in which the school is located, the fewer the computers in the school, the older the equipment, and the slower the Internet connection, if one exists at all.

Lastly, if in-service teachers have access neither at home nor their own school, they may be able to travel to a local college or another school to access their program during the evening or at weekends. This is the least satisfactory arrangement, because it involves considerable administrative effort to obtain the collaboration and support of other organizations to enable access to local equipment, and it also means more disruption and inconvenience and more additional costs for the teachers.

Technology infrastructure issues

It can be seen from the quotation from Njideka Ugwuegbu at the beginning of this chapter that the technology infrastructure in many countries is inadequate to support e-learning. Many schools will have no or few computers, where they do exist they may be old and not well maintained, there may be no telephone access to the school, or if there is, long-distance charges apply and there may in any case be no local Internet service provider. Indeed, in some countries, even the universities have inadequate Internet service (see Akst and Jenson, 2001). Clearly in such circumstances, then at least in-service teacher training delivered locally will be out of the question, especially if the aim is to reach out to remote or isolated communities and/or slums or shanty towns. In some of the less economically developed countries, even pre-service training may be difficult or impossible using e-learning.

Nevertheless, each year in many of the least developed countries, major initiatives are being implemented to improve access to the Internet and to provide computers for schools. Akst and Jensen (2001) report:

'At least 11 African nations have initiated national school-networking programs and most countries on the continent are seeing more and more of their schools connected to the Internet, demonstrating increasing interest from governments, schools and the private sector. A continent-wide organization called SchoolNet Africa has also been set up to enhance teaching and learning by spreading basic information technology skills, as well as by fostering the development of information resources and projects linking students, teachers and administrators across Africa and beyond. (www.schoolnetafrika.org).....

The signs of progress are unmistakable. Four years ago only 11 African countries had any Internet access at all. Now all 54 of them have permanent connections, and although some 20 countries have only one Internet service provider, hundreds of ISPs are open for business elsewhere on the continent, many of them in fierce competition with one another....

The result is that, all things considered, a surprising number of Africans are using the Internet. It is difficult to count actual users, but the number of Internet dial-up subscriber accounts is readily available, and it is striking—more than one million to date..... But each computer with an Internet or e-mail connection supports an average of three users, a recent study by the United Nations Economic Commission for Africa has found. This implies a total African user base of around three million, two-thirds of them in South Africa. That works out to a ratio of one Internet user for every 750 people outside South Africa,

compared to a world average of about one for every 35 people. (The ratio in North America and Europe is about one in three.)'

Naidoo (2001) reports on the growing use of community telecentres for providing shared Internet access in even small communities in developing countries. New technologies such as satellite and wireless can by-pass costly and poorly maintained telephone cable services. For instance, a small VSAT terminal, costing around US\$10,000, linked to a set of low-cost networked wireless transmitters, can provide two-way Internet service for schools and communities along an isolated valley at relatively low cost. Any program considering the use of e-learning for teacher training should do careful research to establish exactly what technology infrastructure is in place, (or will be in place in time for the program), where it reaches, and in particular the most promising access points for the targeted teachers.

However, it is unlikely that any government would fund or create new technology infrastructure for teacher training alone. More likely, when developing a national strategic plan for a loan or grant from international agencies, teacher training would be considered alongside technology infrastructure, business opportunities, community development, and educational reform. Similarly, if a government is considering funding a major e-learning initiative for schools, it will need to consider access and technology infrastructure, as well as teacher training, all as part of an overall integrated strategy.

Human support for e-learning

Even more important than the physical infrastructure are the people required to make the physical infrastructure work. Bates (2001, pp. 37-38) has argued that there are in fact four levels of human support required support effective e-learning.

The most obvious level is the technical support people who are needed to ensure that the networks and equipment are properly installed, operated, up-dated and maintained. Such staff can be described as the *technology infrastructure support staff*. For in-service teacher education, these need to be located as close to the end-user as possible, probably within a local school board. Alternatively, this service may be contracted out (outsourced) to a commercial company. There will almost certainly be a need for a central help-desk for technical support for any e-learning program in teacher education.

At the second level is the media production and services staff, such as interface designers, graphics designers, web programmers, or graduate students who do HTML mark-up. They support the creation and application of educational materials and programs using technology. These can be described as the *educational media support staff*. These are more likely to be located within a central ministry or academic institution responsible for teacher training, although increasingly in some countries school boards are employing such staff to provide assistance to local teachers.

At the third level are those that provide educational services and expertise, such as curriculum design, instructional design, faculty development, project management, and program evaluation, to support the use of technology for teaching. These can be described as the *instructional design support staff*. Such staff are still relatively rarely used, but are essential for the design of effective e-learning programs. However, in some countries such staff may not exist at present. If not, some program of foreign training or recruitment will be necessary.

The fourth level is made up of the professors, instructors, teachers or subject matter experts, who create content and provide the teaching over the networks and infrastructure. These can be described as the *subject experts*.

There is a tendency to focus solely on subject experts for the delivery of e-learning programs, but they will not necessarily have the expertise, interest or time to deal with technology infrastructure, educational media production, instructional design or project management. It is important then that before launching an e-learning program, an analysis is made of the local human support staff needed and available for such a program, and gaps will need to be filled, if possible.

Funding infrastructure

It will certainly be essential to ensure that there is adequate funding provision for infrastructure and support staff for any e-learning program, even if some of that funding comes from other sources than the e-learning program budget. In this respect, it is important to see infrastructure funding as an operational (or recurrent) rather than a capital (or once only) cost, and often as a shared rather than a direct cost (that is, the infrastructure is used to support a number of different programs). Using e-learning then for teacher education is likely to work best when it is combined with programs to increase computer and Internet access to students, when the e-learning program can share or build upon existing infrastructure, and when the true costs (and benefits) of infrastructure support are fully understood and funded on a system-wide basis.

Equity issues

The issue of access to e-learning programs was discussed earlier in this chapter, but did not focus specifically on questions of equity. Concerns are often expressed that using computers for education increases the digital divide, enabling those in more developed countries and those with higher incomes to benefit at the expense of the rest. For instance, UN Secretary General Kofi Annan has stated that:

‘The advent of the Internet is considered by some to be as significant in its effect on society as that of the telephone or even the printing press. While it took the telephone nearly three-quarters of a century to reach 50 million users, the World Wide Web achieved the same feat in only four years. In fact, from the Internet's humble beginning in 1981, when it supported a mere 213 hosts, the individual computer systems used to connect to the Internet, and only a few thousand users, it had grown by 1999 to over 56 million hosts with more than 190 million users.

These figures are certainly impressive, but a closer look reveals that there are great disparities in Internet access across geographic regions. Today, there are almost as many hosts in France as in all of Latin America and the Caribbean, and there are more hosts in Australia, Japan, and New Zealand than in all of the other countries in the Asia-Pacific region combined. Perhaps most telling, there are more hosts in New York than in all of Africa.

This year's World Telecommunication Day highlights the emergence of this "digital divide." While people all over the world do access the Internet, Internet users still account for only five percent of the world's population. Furthermore, 85 percent of all Internet users live in developed countries where ninety percent of all Internet hosts are located.

The benefits of the Internet to developing nations are clear. It can allow businesses to sell goods and services directly to customers across national boundaries and facilitate the delivery of basic services, such as health care and education that are unevenly distributed among the world's population.

Yet, in order for developing countries to reap these benefits, there are some things we must first ensure. The content of the Internet must be available in many different languages, and not just a privileged few. All nations must have the requisite infrastructure, most notably telephone lines. The price of Internet access must be brought within the reach of all people.

Knowledge has long been synonymous with power, but with the advent of the Internet, access to knowledge is quickly becoming a requirement for power whether social, political or economic. In our increasingly interconnected world, we must work together to see that all people have access to the knowledge the Internet has to offer.'

Annan, 2004

Akst and Jensen (2001) report:

'Sub-Saharan Africa [excluding South Africa] has by far the least developed infrastructure in the world. Although encouraging trends have emerged in the last few years, the differences between development levels in Africa and the rest of the world are especially wide in the area of information and communications technologies. Computer penetration is less than 3 per 1,000 people.... In some ways, Internet use in Africa is not so different from Internet use elsewhere. It is disproportionately white, educated and affluent, and the 'net is used by some people for the same panoply of ends as in the rest of the world.'

The digital divide though can be found within as well as between countries. For instance, in the United States, a survey in 1999 conducted for the National Center for Educational Statistics found that teachers in low minority and low poverty schools were generally more likely than teachers in high minority and high poverty schools to use computers or the Internet for a wide range of activities, including gathering information at school, creating instructional materials at school, communicating with colleagues at school, and instructing students. For example, 57 percent of teachers in schools with less than 6 percent minority enrollments used computers or the Internet for Internet research compared with 41 percent of teachers in schools with 50 percent or more minority enrollments (<http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000102>, table 2.4).

In developed countries home ownership of computers breaks the general trend for domestic electronic equipment. In general, low-income working families have been relatively early adopters of technology such as colour and satellite TV, video-cassettes and DVDs, and mobile phones. With respect to computer technology though, ownership is almost linearly related to income: the lower the income, the less likely there is to be a computer and Internet access within the home.

However, although poverty and lack of access to the Internet are strongly correlated, poverty is not the only factor that limits access to the Internet. Akst and Jensen (2001) report:

'...poverty probably isn't the main impediment to Internet use.....There is general agreement among those with long experience trying to bring information technology to Africa that the difficulty is highly regulated telecommunications services, usually appearing in the form of a moribund state-owned monopoly that is expensive and wary of change - especially of change embodied by a medium as potentially subversive as the Internet. African governments have the power to alter these circumstances, and gradually, some are doing so...'

There can also be strong gender differences in access to Internet technology. Brisco (2000) reported:

'In the U.S., for the first time in the history of the Internet, women are outnumbering men in Internet usage. In Asia, this is not the case. Men represent 78% of all Internet users in Asia, while women account for only 22%.'

The appropriateness of e-learning for teacher education will depend very much on the groups being targeted and the existing national Internet infrastructure. If the target groups are mainly in urban schools or pre-service teachers in universities or colleges in larger cities, e-learning is probably a viable option. If on the other hand the target groups are teachers in remote rural schools or in schools with no or unreliable electricity, then e-learning is not an appropriate choice, unless special arrangements can be made to provide low cost or free access to computers and the Internet.

However, caution is needed in jumping to conclusions about computer and Internet ownership, because access is particularly volatile. The number of Internet users in Canada who were female rose from 27 per cent to 51 per cent in one year (1997). The U.S Department of Commerce (2002) census reported that in the U.S. census conducted on September 2001 143 million Americans (about 54 percent of the population) were using the Internet — an increase of 26 million in 13 months. In September 2001, 174 million people (or 66 percent of the population) in the United States used computers. The same report indicated that:

'Computers at schools substantially narrow the gap in computer usage rates for children from high and low income families....

Between December 1998 and September 2001, Internet use by individuals in the lowest-income households (those earning less than \$15,000 per year) increased at a 25 percent annual growth rate. Internet use among individuals in the highest-income households (those earning \$75,000 per year or more) increased from a higher base but at a much slower 11 percent annual growth rate. Between August 2000 and September 2001, Internet use among Blacks and Hispanics increased at annual rates of 33 and 30 percent, respectively. Whites and Asian American and Pacific Islanders experienced annual growth rates of approximately 20 percent during these same periods.'

Thus it can be seen that low-income families in the U.S.A. are beginning to catch up with higher income groups in terms of Internet and computer ownership. There is no guarantee that the same patterns of access in economically developed countries will also occur over time in less economically developed countries, but nevertheless the rate of growth in Internet and computer access worldwide remains strong.

It is clear then that any e-learning program in teacher education needs to think carefully about how to deliver the program, where the trainee teachers can access the program, and the likely additional infrastructure costs needed to ensure and maintain access. This means being focused on the target group, collecting reliable information about access to computing and the Internet for the particular group targeted, and having some funding to supplement or purchase equipment and networks.

Cultural and language preservation issues

Developing high quality e-learning programs requires a high level of skill and substantial resources. There would therefore appear to be an obvious advantage in buying in programs from elsewhere, as this is likely to be cheaper than developing programs from scratch at home. However, most e-learning programs developed for teacher training have to date been developed in English, and to a much lesser extent in French and Chinese. In many cases though this will not

meet the needs of teachers whose first language is not English (or French or Chinese). Even where the teachers understand English or another language, the materials are unlikely to be appropriate for the local context.

This is because international universities develop e-learning programs initially for their own students, then look around for a market outside. Most e-learning materials produced by private sector companies, such as publishers, also reflect the language and culture of origin. The national curriculum of the country where the materials were developed will in most cases be different from that of the importing country, and this is likely to be reflected also in the context, examples and cases embedded within the e-learning materials. Such programs or materials will need considerable adaptation to local languages, culture and history. What works in a school environment in Australia may be inappropriate in Viet Nam. The cost of adapting imported material, combined with the hard currency used to buy the materials, often results in a higher cost than developing from scratch (although the imported materials may provide a framework for the design of local materials). Furthermore, buying international programming does not help a country develop its own capacity for e-learning. Money that could be spent on developing local capacity goes out of the country.

It is important to recognise that education is as much about process as it is about product. Education is about the interaction between students and teachers, as well as access to content. Nevertheless, databases of digital resources for learning that include print, audio, graphics, video and multimedia are being made accessible to other users either free or commercially. One common term for such materials is 'learning objects', and there are various attempts to develop common international standards that will facilitate the quick and easy online search, access, selection, delivery, and where necessary financial transactions for the use of such materials. Online access to free or low-cost learning materials already developed elsewhere can be extremely valuable for teacher education, and can lead to huge savings in time and expense in developing materials from scratch. Even where the object is developed in a foreign language, it may still be cheaper to change the language and retain the graphics or animation than build an object from scratch. However, while there is a great deal of research and development happening in the field of learning objects at the time of writing, purely automated solutions are still at the conceptual and design stage. Furthermore, there are issues of copyright, intellectual property and appropriate business models that still need to be resolved.

Thus, rather than wait for fully automated solutions for the search and retrieval of digital resource materials, it is important to start developing immediately national archives of digital materials that reflect the culture and language of the country, and that are freely available to teachers and students. These archives can range from whole curricula online, such as the programs or courses of an institution, to very small objects, such as a graphic or animation, which can be accessed over the Web and downloaded for use in a particular piece of teaching. Such material then can be used both for teacher training and for teaching within the country. A good example of this approach is Brazil's Biblioteca Virtual (Virtual Library) developed as part of the Escola do Futuro project at the Universidade de São Paulo. This provides an archive of works in Portuguese that can be used in the Brazilian school or university systems (see <http://www.bibvirt.futuro.usp.br/>).

Any government interested in establishing a database of indigenous or locally developed online materials will need to ensure that it is aware of the growth of international standards in these areas (see Porter 2001 for an excellent discussion of this issue). It will also need to be aware of the issues around copyright and intellectual property (see Bates, 2000, for a more detailed discussion of this issue). At the least, though, governments who fund such initiatives can make sure that such material is freely available to all educational institutions within the country, once created.

Consequently, in most countries it will be important to develop at least a national capacity for the design, production and delivery of e-learning materials for teacher education that reflect national language, culture and curriculum. In those countries with different cultures and languages within their borders, a more decentralized policy of local development may be necessary. On the other hand, where several countries have common or overlapping language and culture, they could work together collaboratively to develop and share digital resources within each of the collaborating countries, thus offsetting the high cost of developing local digital materials from scratch.

The importance of developing a national capacity for the design, creation and delivery of e-learning reinforces the need to hire and train people with skills in curriculum design, instructional design, media production, educational web programming, and ICT technical support skills. Because people with these skills are not readily available in many countries, partnership or collaboration with foreign institutions may help institutions to build up such capacities. For instance the senior administration at Tec de Monterrey in Mexico was anxious in 1996 to move more actively into e-learning but lacked the skills in-house to do this on a large scale. Tec de Monterrey developed a partnership with the University of British Columbia in Canada to develop initially a joint certificate program on e-learning that later developed into a full joint Masters in Educational Technology that is now offered globally online in both Spanish and English. This, along with a number of other activities, enabled Tec de Monterrey in 2004 to move away from a distance education system based heavily on satellite broadcasting to a fully Web-based distance education system. The advantage of a partnership with a foreign partner is that it allows the local institution access to skills and expertise in both e-learning design and content, while ensuring that the materials developed meet national language, culture and context. More importantly, it helps develop local skills in e-learning that remain within country after the partnership or program ends.

Curriculum issues

Perhaps the biggest policy issue is the extent to which national curricula should be modified to take account of the potential advantages of e-learning within the school system, as this will have significant implications for the delivery of teacher training.

E-learning can deliver a wide variety of approaches to curriculum and teaching methods. For instance, it can be used for the transmission and comprehension of information, using text, graphics and animation to enrich the presentation of information, and automated tests, immediate feedback, and even diagnosis and alternative treatments to compensate for or limit lack of understanding on the part of students. Such an approach has the added advantage of not necessarily requiring Internet access. As long as students have access to computers, these curriculum features could all be handled through the low-cost distribution of CD-ROMs. This also has the advantage of controlling students' access to knowledge, so that students do not have access to pornographic sites or other unsuitable materials.

However, as Collis and Moonen have pointed out in Chapter xxx, using e-learning to reinforce traditional approaches to learning is not the main reason why e-learning is promoted so heavily. A major rationale for e-learning is that it allows for communication both inside and outside the traditional classroom, and freedom to explore a wide variety of learning resources. This relates back to the earlier section of this chapter with respect to the skills that need to be developed in a knowledge-based society. E-learning can be used to develop such skills as knowledge management, networking, team-work, IT-based communications skills, critical thinking and problem-solving. However, in many countries such skills would be difficult to achieve within traditional national curricula, which often have a strong emphasis on national control of content, and a teaching method based on information transmission and rote learning. Thus if the intent is

to bring about a shift in the kinds of skills students will need in a knowledge based society, the use of e-learning will need to be accompanied by and integrated with curriculum reform.

From a teacher training perspective, the issue will be whether to use e-learning to deliver teacher training so that it mirrors or represents new approaches to teaching in the classroom that can be enabled by e-learning, or whether the aim is to leave the national curriculum untouched, but use e-learning to spread more widely teacher training based on the existing national curriculum. E-learning can be used effectively to support either approach to teacher training. There are advantages in introducing teachers to e-learning before it starts to be applied in the classroom. However, the use of e-learning for teacher training is more likely to lead to greater gains if it is combined with curriculum reform that aims to exploit the benefits of e-learning for teaching within the school system. Nevertheless, it is recognized that combining reform of both teacher training and the national school curriculum at the same time may be too big a bite to chew for many governments or Ministries of Education.

Teacher certification issues

The way teachers are certified varies considerably between countries. However, there may be issues in using e-learning for teacher training where certification is influenced or controlled by independent bodies at arms-length from government, or organizations heavily influenced or represented by key stakeholders, such as parents or teachers' unions. Such regional accreditation agencies and professional bodies may have policies in place that prevent the recognition of technology-based or distance programs for accreditation or professional qualifications. For instance, at the time of writing (2004) the British Columbia College of Teachers in Canada, which is responsible for the evaluation of qualifications and the issuing of teaching certificates in the province of British Columbia, states that:

12. Correspondence-based or Distance Education teacher education programs are not recognized as comparable to British Columbia teacher education programs. Programs not regarded as comparable to BC programs will be denied certification.

<http://bcct.ca/certification.html>

This somewhat blanket policy is based on the idea that teachers require assessment based on practice with 'real' children in 'real' classroom contexts. However, there are clearly major aspects of teacher training, such as philosophies and theories of education, lesson planning, or indeed the use of e-learning for teaching, that do not require the physical presence of the teacher in the classroom. Therefore, as Bates and Poole (2003, p.19) report, many regional accreditation and professional qualification bodies are now moving away from a blanket ban on a particular mode of delivery. Instead, they are assessing the quality of the programs, irrespective of delivery methods. This approach requires the development of proper quality assurance standards. Although standards may be set, or agreed to, by the accreditation and qualification agencies, the responsibility falls on the institution offering the program to ensure that these standards are met.

Whatever the arrangements for teacher accreditation within a particular country, the introduction of e-learning for teacher training is likely to require close consultation with the accreditation agencies.

Main barriers in implementation of e-learning in teacher education

This chapter has looked at a number of issues that need to be considered at a policy level when implementing e-learning for teacher training. The three main barriers are likely to be lack of physical infrastructure, the resistance of people and institutions to change, and lack of skilled people in the field of e-learning.

The physical infrastructure requirements for the successful implementation of e-learning for teacher training are demanding. Easy access to computers, accessible, reliable and cheap Internet service, and low-cost telecommunications are all important requirements for the successful implementation of e-learning. In many countries it will be difficult to meet such requirements at present, although certain areas of e-learning for teacher training, such as for full-time, campus-based pre-service teacher education, may be easier than for other areas, such as remote, rural-based, in-service teacher education. Furthermore, the physical infrastructure in many countries is rapidly improving. Thus the timing of the introduction of e-learning is critical, and will vary from country to country. What may not work today may well be feasible next year; what will work in Mexico today may well work in Guatemala in five years' time.

The second major barrier to e-learning is resistance to change. The fear of many teachers due to their lack of skills in using technology is a major barrier, as is resistance from unions fearful of technology replacing teachers, and professional accrediting bodies who are not well informed about the potential and experience of using e-learning for teacher education. These fears can be overcome by good communication, consultation and the full involvement of stakeholders in decision-making about the use of e-learning for teacher education.

The final barrier is the lack of local people with the necessary skills of curriculum and instructional design, media production, Web programming and technical support. Without such people, the development of relevant national curricula and materials for the delivery of teacher training will be difficult. This is one barrier that will require local recurrent funding if the barrier is to be removed.

In conclusion, there will be situations where e-learning for teacher education will not at the present time be a suitable strategy. However, in many cases, careful attention to policy and implementation issues will enable what may seem initially insuperable barriers to be overcome. E-learning therefore can be a major instrument in many countries for improving the quality and reach of teacher education.

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