Distance Education for Technology Teachers

By P. John Williams

This article describes a distance education approach that has been developed and implemented in Mauritius, Seychelles, and Botswana to help overcome limited teacher training opportunities and so help meet the demand for well-qualified technology teachers. It outlines the principles of course design, the mixed mode of delivery, and some of the issues of course delivery derived from program evaluations.

Technology in its current form is a relatively new subject; it has a brief history in schools as a component of general education (deVries, 1993; Layton, 1993). In some countries it has derived from vocational programs such as in Taiwan and Australia, and in others it is influenced by craft subjects such as in Sweden. Traditional technology education has also generally been gender biased, with activities designed to reflect gender stereotypes. The new technology education is moving away from narrow vocational preparedness and from gender specificity. The culture of school technology identified in the early 1990s (Layton, 1993; Puk, 1993) is developing, though still in its infancy, into a new paradigm about values, practices, content, methodologies, and capability (Kimbell, 2003).

The developing patterns of technology education in many countries challenge some of the traditional characteristics of schooling such as the decontextualization of knowledge, the primacy of the theoretical and secondment of the practical, and the organization of the curriculum along disciplinary lines. In contrast, technology education emphasizes the context of the technological activity, learning is achieved through the interaction of theory and practice, and it is interdisciplinary.

Some of the trends in technology education, which are obvious in a number of countries, include a movement from:

- Teacher as information giver to teacher as facilitator of learning.
- Teacher-controlled learning to teacher-learner partnership.
- Teacher-centered learning to student-centered learning.
- Time, age, and group constraints to individualized learning.
- Materials-based organization to needs-based activity.
- Product-centered to process-centered.
- Elective area of study to a core subject.
- Social irrelevance to socially contextualized.

Within the context of these trends, there is also a great degree of diversity throughout the world in technology education (Williams, 1996b). This diversity ranges from the absence of technology education in Japan (Elliot, 1990) to its compulsory study by all students in Israel (Israel Ministry of Education, Culture and Sport, 1996), an instrumentalist approach in Finland (Kananoja, 1996) to a basically humanistic approach in Scotland (Birnie & Dewhurst, 1993), a focus on content in the United States to a focus on the process in the United Kingdom, an economic rationalist philosophy in Botswana

Table 1. Comparison of the World's Population in Terms of Availability of Computers and Phone Lines

Category of Country	% of World Population	PC's/1000	PL's/1000
Low Income	40%	4	27
High Income	14.9%	346	583

Source: (World Bank, 2000).

(Molwane, 1993) and China (Wu, 1991) to a more liberal philosophy of science-technology-society in the United States (Layton, 1988), a staged and well-supported implementation of change as proposed in South Africa (Ankiewicz, 1993) to a rushed and largely unsuccessful implementation in England (McCormick, 1993), integrated with other subjects such as science in Israel, or as a discrete subject in Australia (Williams, 1996a).

Both the commonalities and the diversity are appropriate. The type of technology education developed within a country must be designed to serve that country's needs and build upon the unique history of technical education, resulting in a unique technology education program. This uniqueness challenges some of the notions related to the internationalization of the curriculum, particularly in the area of technology education. Other more traditional disciplines have developed an internationally acceptable body of knowledge, but technology has not and probably never will because of its variable historical significance and the diverse needs of different cultures.

Forms of Distance Education

A typical definition of distance education is the delivery of instruction in a format that separates the teacher and learner, often both in time and space (Keegan, 1980). It tends to be an umbrella term that may encompass more specific forms of education such as distributed learning, independent study, correspondence education, satellite education, etc. The focus of this discussion is text-based distance education, supplemented by intensive face-to-face sessions.

The factors contributing to good quality education are considered to be the same regardless of the mode of delivery, the country, or the setting. This is because of the "no significant difference" phenomenon associated with distance education research (Frost, 1998). The key variables are the quality of content and the support provided for the students, not the technology (Eastmond, 2000). "People learn as well from traditional print based correspondence courses as they do from the most slickly produced and/or interactive telecourses" (Russell, 1997, p. 6). If not designed and delivered well, distance education, of whatever mode, will only exacerbate poor quality instruction and compound already existing educational problems.

It is difficult to find current research about print-based distance technology education, this having been overtaken by online and Internet modes of delivery. Of the 558 articles on technology education referenced by this researcher, and the 526 full-text online journals accessed through WilsonWeb, a number of searches revealed no research since 1990 on print-based distance technology education.

A comparison of this research emphasis on electronic forms of distance education with the state of the world's population in terms of computer availability, phone lines, and arguably that portion of the population in most need of education indicates a significant imbalance (see Table 1). In low-income countries (40% of the world's population) there is one computer for every 250 people; in high-income countries (14.9% of the population and generally the origin of online distance education) there is one computer for every three people. In low-income countries there is one telephone line for every 37 people; in high-income countries there is one for every two people. There are about 400 million computers in the world, and 300 million of them are owned by 15% of the world's population.

The United States and the former Soviet Union have 15% of the world's population but operate 50% of the geostationary satellites (World Bank, 2000).

It would seem plausible to conclude that the current direction of distance education research is not serving the interests of the majority of the population who need an education and are typically undereducated. This is compounded by the high proportion of untrained and unqualified teachers in low-income countries (Nielsen, 1997) and reinforced by the evaluation of distance education reported in this article.

Course Design

A teacher education course in technology education derives its content from three main sources. One is the educational system for which the teachers are being trained. Information from this source includes syllabi, methodologies, school contexts, etc. The second source is the technological activity that takes place in society, and the third source is from the discipline that is being studied, in this case technology education. The research and literature of the discipline gives guidance on content, structure, learning patterns, and methodologies.

All these systems are vital sources for the design of a teacher-training course in technology education. Graduates need to be suited to the system in which they are going to work, but their tertiary studies should be more than a repetition of the respective secondary syllabus at a deeper level.

Each course reported in this article was designed to accommodate the above characteristics in the context of the appropriate education system. This meant significant local input with regard to the local educational system and the social/technological context. It was found that it is difficult to do this at a distance and requires face-to-face negotiation. The core content and instructional methods were derived from existing units of study, which were then customized and contextualized to suit the specific environment. The background and learning styles of the students are also important to consider, and to some extent knowledge in this area develops as the course proceeds. This revision and sensitization process has been repeated each time the course has been offered, as it is not possible to internationalize a technology education curriculum to the extent that it is generalizable and relevant regardless of the country of implementation.

A guiding principle of the course is that students must learn how to learn. With technology changing as rapidly as it is currently, there is a limited life span in the skills students are now taught. Students must be taught how to independently develop new skills and how to find out about new materials, equipment, and systems. Then when the need later arises for personal professional development or for school development, teachers are well equipped for the task.

The contextual goal of the courses is also sustainable development within the country. This applies to individual teachers who, as a result of courses of study, will:

- develop relevant and current content knowledge in technology education;
- incorporate contemporary pedagogical skills into their teaching;
- be better equipped to guide the development of young students; and
- understand international best practice in technology curriculum development.

Typically, courses had to be designed quickly. The identification of a market opportunity was followed by the development and submission of a proposal to the key people in the market. A lengthy delay at this stage could have resulted in missed opportunities. The initial proposal was clearly identified as a flexible starting point for discussion and negotiation about the structure and content of the course, and then after a series of discussions and meetings, the specifics were modified and developed later.

Initial proposals were not specifically costed, but a range of delivery options were outlined, with an indication of the relative expense of each option. Sponsors do not necessarily choose the least financially expensive option, as other factors such as ease of administration and perceived quality of delivery are important factors. In one country the most expensive delivery option was selected because that was the traditional approach to upgrading teachers in that country.

If the market opportunity was identified by a person not connected with the coordination or delivery of the course, then it was found necessary for a person expert in the content of the course to visit the sponsors to negotiate the course details, answer questions, and develop an understanding of the environment in which the course would be delivered. Important information related to facilities and equipment, prior experience and education of the potential students, curriculum, cultural and regional considerations, and local coordinators.

As a result of these initial visits and communication, a specific and costed proposal and course design was developed and signed by the appropriate parties. Responsibilities of all involved were specifically detailed. This detail is essential and can significantly impact on course success. For example, in one course student consumables were the responsibility of the local sponsors. This proved to be a greater expense than was anticipated and would have impacted significantly on university revenues.

Course Delivery and Structure

The Design and Technology Bachelor of Education (Secondary) program is designed to prepare students to teach design and technology at all levels in the secondary school. The award is granted after the successful completion of four years of full-time study (or equivalent), that is 8 semesters at 4 units each semester, or 32 units. The remainder of the suite of undergraduate courses available in this area of D&T include a three-year Bachelor of Arts degree, a two-year Bachelor of Education upgrade for diploma holders, and a one-year Bachelor of Education upgrade for Bachelor of Arts degree holders. These are all subsets of the 32 units of the Bachelor of Education, which provides a pool of units from which to select the most appropriate for the specific market. So for example, the 16 units of a two-year Bachelor of Education upgrade offered in one country may be different from that offered in another because they are selected and matched to the specific needs of the market.

The courses are delivered through a combination of distance mode and intensive workshops/lectures over a period of up to four years. Students study part time, and enroll in two units per semester. The part-time study involves readings, assignments, assessment, and examinations being forwarded to the students in concert with a period of intensive lectures/workshops in their country. This provides about 30 hours of face-to-face interaction with the lecturer for each unit and is delivered in about the middle of each semester during the school holidays. So students do some study both before and after the on-site classes.

The advantages of this mode of delivery include:

- no disruption to schools through the absence of teachers;
- education activities, discussions, and applications can be grounded in current practice; and
- the opportunity for collaborative teaching and research between local staff and university lecturers.

The upgrade course consists of three types of units:

- Education Studies: studies in the theory of education, educational psychology, and teaching studies and practice.
- Curriculum Studies: studies of relevant curriculum resources and related teaching.
- Content Studies: appropriate specialization content.

The balance of these units varies depending on the local context and needs.

Some courses were proposed as a joint venture between the university and the local ministry of education (in the case of a sponsored cohort of students), with the provision of concurrent opportunities for postgraduate study (MEd or PhD) for local lecturers. This postgraduate study can be done by distance, and opportunities for supervision and guidance would arise through the undergraduate course activities. In some instances a fees-only postgraduate study scholarship for the top academic student has been provided upon completion of the course. Other courses were advertised and offered to teachers who then are responsible for their own fees.

Costs and Responsibilities

Generally, distance education incurs lower costs per student than traditional face-to-face education, often generated through economies of scale, but this is offset by large dropout and repetition rates. The UK Open University has a completion rate of 49% (200,000 students), 28% at the Indira Gandhi National Open University (431,000 students), and 10% at the Korean National Open University. Completion rates tend to be lower in less-developed countries as students in those contexts typically enroll in distance programs as a matter of necessity rather than from choice (Latchem, Abdullah, & Xinhfu, 1999). The completion rates for the courses described in this article vary from 90% to 100%.

For a specific program offered to a foreign government by a university, the criteria which form the basis of value-for-money decisions include the reputation of the university, the level of understanding of the delivery context, the flexibility of both content and mode of delivery options, fees, and politics.

In this situation the sponsor's responsibilities may include:

- nomination and resourcing of a locally based program coordinator;
- recruitment of the cohort of teachers into the program;
- the provision of an appropriate venue for the on-site teaching;
- funding time off for course participants, for example, one day/fortnight during semesters;
- the provision of consumables and technical support for the on-site teaching;
- organization and funding of mentors; and
- organization and invigilation of examinations.

The university's responsibilities may include:

- all costs associated with university or local staff conducting the in-country teaching;
- provision of all distance education materials;
- implementing enrollment and recording procedures;
- reasonable remediation of failing students;
- setting and marking assignments and examinations; and
- granting the relevant degree.

If the government sponsors the program, it is funded on the basis of a specific number of students being the minimum in the cohort. If the number of students drops below that level, the cost will be maintained. It is generally agreed that a specific number of students above that level can be enrolled for no extra cost. When individual students are paying their own fees, the university applies a formula of income and costs to determine course viability.

Issues

The following are some of the issues that have arisen from the delivery of distance technology education to technology teachers and the evaluation of those programs.

Level of Technology

Technology education in teacher training serves the dual role of modeling experiences and activities that teachers can implement in their schools when they begin teaching and experiences that enhance their understanding of technology. Both are important because teachers need starting points for their teaching, but also need a sophisticated awareness of the nature of technology. In extending educational experiences across cultures, the correct balance, and the justification of the balance between these two goals, is imperative. In-country experts and the students themselves can provide guidance on achieving this balance. The principles of appropriate technology become relevant in the selection of technological activities and the context of application of the processes of technology education.

In relationship to the mode of delivery, the instructional technology seems not to be a key variable for success. As Frost (1998) has pointed out, any socially just delivery system must ensure that we are not just servicing a small group of well-off elites. New and advanced technologies will expose traditional cultures to Western values and may create as many problems as it solves. Resulting unrealistic learning behaviors may cause distance education to be viewed as a cultural Trojan horse (Wennersten, 1997). So the level of technology must be at the same time socially equitable, challenging to the participants, and accessible.

Local Capacity Building

There is the recognition that as a result of each course, apart from having better qualified graduates, more local capacity to deliver the course in the future should be developed. The experience has been that unless such capacity building is detailed in the initial contract, it is very difficult to develop during the project. People are very busy, and unless there is some compulsion to undertake additional tasks, despite any long-term advantage that may accrue, opportunities will not be taken up.

The type of collaboration necessary to achieve this end brings with it a number of dangers. One is the danger of cultural imperialism, which is difficult to resist when the visiting lecturers are presented as the international experts. The other danger is the "trendy" aspect of collaboration. "Too often alliances are cobbled together for the purposes of proposal submission. Alliances without 'roots,' without an investment in partnership development, will limit the potential for success of projects" (Gerhard, 1997, p. 3).

Facilities

In some countries the facilities are not available to offer units that would normally be considered core units. For example, in technology education these could relate to computer-assisted drawing and machining, advanced materials, electronics, and a range of computer-based units. In some countries these units cannot be offered; in others the unit content can be modified to enable it to be offered in an appropriately contextualized way, for example, with the use of share-ware software rather than expensive commercially produced packages or with local experts discussing local technologies.

Local Politics

There is invariably a political dimension involved in the context in which the course is delivered. A local course coordinator is invaluable in steering through the potential pitfalls of teaching site selection and dealing with local institutions and authorities, which may respond to a variety of agendas. This can nevertheless be a source of frustration as the sense of urgency felt at the source institution about material availability, for example, is not always replicated in going through the protocols in the local delivery context.

Lecturers

It takes some time interacting with a class for a lecturer to develop a rapport with students, and when they spend 30 hours together over one or two weeks, the relationship seems to become quite strong. Students do not want to go through this "getting to know the lecturer" period with a new lecturer for every unit. However, if the "expert" in each unit is the person sent to do the teaching, then many different people are involved in a course. It has been necessary at times to restrict the number of people involved in course delivery in order to help ensure student comfort.

In instances where it is appropriate to localize course material, a local expert may be involved in presenting to the students. This can, however, be perceived negatively by the students, who consider they are paying for an overseas course and that is what they want, not local lecturers.

Currency

Currency restrictions may inhibit the ability of students to purchase course material. This can occur at both personal and national levels if there is close monitoring of the country's foreign currency reserves. This has been overcome at times by selling resources in local currency to the students and then using that income for local expenses of the project, but still may result in curtailing the resources available to students.

Course Duration

Some of the students have been dissatisfied with the duration of their course. They would have preferred, for example, to study for three semesters per year and complete a two-year full-time course in under three years part time than to study for two semesters each year over four years. This more intensive mode of delivery places increased pressure on the source institution and may result in negative consequences on other aspects of departmental activity.

Communication

Because standard means of communication such as mail, Internet, and fax can be unreliable or nonexistent, communication with both students and coordinators in the host country can be frustrating. Typically, some students have Internet connections, and mail and fax are unreliable. This means forward planning is critical, and normal processes may sometimes need to be circumvented. For example, an unreliable mail system resulted in a batch of exam papers going missing and alternative strategies had to be devised; and assignments, both to and from students, are express mailed together to a central location rather than to individual students.

Conclusion

For many students, text-based distance education represents their only source of educational opportunity. In the area of technology education, a successful mode of delivery incorporates a period of intensive face-to-face interaction with a lecturer. Detailed planning and the contextualization of both content and methodology is vital, but flexibility in the implementation of those plans is just as important in order to overcome unforeseen barriers. Key variables for success include high-quality content, appropriate methods, and student support to enable them to effectively utilize new knowledge.

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