CHAPTER FOUR
Guidelines for Making Decisions About Which Technologies to Introduce into Teaching and Learning Environments

1. INTRODUCTION

The purpose of this chapter is to present a framework for making decisions about which technologies to introduce into learning environments in order to enhance education and training programmes. It will present a tool which can facilitate the procedures that any decision-makers may use when making decisions about the use of different technologies in education and training programmes, regardless of whether the decisions are being taken by government departments, single institutions, or consortia of organizations, whether at local, provincial, or national level.

1.1. PLACING DECISION-MAKING PROCESSES IN CONTEXT

Although the primary focus of this chapter is to present a suggested approach to decision-making processes, the team is fully aware that there is little value in considering such processes without some understanding of the requirements for effective decision-making. An implementing, managerial, coordinating, or convening mechanism of some kind has to be set up to stimulate, guide, advise, inform, monitor, and evaluate both the technology selection process, and the teaching and learning processes within which the chosen technologies will be used. Regardless of the level at which decisions are made, therefore, it is essential that appropriate managerial capacity is in place, able to lead the process of applying the decision-making strategy recommended below and to deal with the impact on teaching and learning brought about by the introduction of the chosen technologies.

Investigation team members are of the opinion that the management structures required for this decision-making process should permit and support maximum flexibility, and openness. One way in which effective decisions might be supported within such management structures would be through the development of a 'Technology-Enhanced Learning Network'. This 'network' would consist simply of the pool of all existing educational resources in the country (human and financial). The aim would be to create a managed network of content sources, instructional designers, communications technology specialists, educators, and learners. Within such a network, programmes can be planned and designed centrally or provincially, produced and delivered through a range of communications media, and integrated with local activities of student groups and the activities of individual students, supported by specialists in inter-personal

Refer to page 96 to see the proposed initiatives.

Refer to page 283 for more information on new approaches.

interaction and learning, located in a wide range of teaching and learning sites. The development of this network, and communication within it, could be facilitated using a range of strategies (described in more detail through the proposed initiatives in chapter five⇦). The development of such a network is consonant with the new approaches to education and training and to planning, allocating, and managing resources which have been outlined in appendix G⇦.

Within the network, enabling mechanisms need to be established to manage decision-making processes. The nature and structure of these mechanisms would vary considerably depending on their location (institutional, inter-institutional, provincial, or national). Their purpose would be to 'mix-and-match' resources from the full range available nationally or provincially, on a project-by-project basis. Depending on the project, they could be set up to include the national and provincial departments of education, or could be set up within these Departments. In general, these enabling mechanisms would need to have five 'coordinators' responsible for specific functions. Each will be described briefly:

Planning and Evaluation
The role of the planning and evaluation coordinator in the strategic decision-making process is to represent the research regarding which learning needs can be most effectively and efficiently met through technology-enhanced learning programmes. S/he would also lead in monitoring and evaluating both the development of the programmes and their effectiveness.

Programme and Course Design
The role of a course design coordinator is to facilitate in organizing (temporary) project teams, consisting of content specialists, instructional designers and learning specialists, from educational, training and other human resources to design and produce programmes that meet the identified learning needs.

Technology Selection
A technology coordinator keeps special awareness of communications technologies, and possibly other technologies relevant to particular education and training programmes. S/he provides data and leadership in discussion during the selection of the combination of communications media. This coordinator would provide information on the availability within the country of specific print, audio, video, computer, production, and telecommunications resources as may be required by a particular course or programme.

Instruction and Student Support
An instruction and student support coordinator would provide a link between course design and production and the network of sites of teaching and learning⇦. The recruitment and registration of students, examinations, local interaction between students and instructors, and other related student support activities, are all managed at the local level.

Refer to page 67 for a description of 'sites of teaching and learning'.

Professional Development and Information Services

A professional development and information services coordinator plans, prepares, and perhaps provides professional development in the use of technology. Because the field is so new and changing so fast, much of the most useful information is only available electronically, and in 'fugitive' literature such as conference proceedings, monographs, and journal articles. This coordinator would, therefore, be kept in touch with developments worldwide through information services provided at a national level⇨.

Note
A proposed initiative recommended in chapter five is the establishment of a clearing-house of information to provide this service nationally.
Refer to page 100

1.2. BUILDING A DECISION-MAKING FRAMEWORK

> Because of a lack of generally agreed criteria for media selection in education and training, crucial technology decisions have tended to be made primarily for commercial, administrative or political reasons: the availability of spare broadcasting capacity; an offer from suppliers of free or cheap equipment or services; the comfort level of academics with technologies that replicate the lecture format; or the enthusiasm of a key decision maker for a particular technology. When a new technology has been introduced , it has more likely been added on to existing services, rather than to replace more costly or less effective teaching approaches.
>
> Tony Bates[1]⇨

See Bates, A. 1995, Technology, Open Learning and Distance Education for a very useful introduction to the use of technology in education and training.

Although there does exist a number of models of media selection, most of them have their roots in the systems approach to instructional design, which, although influenced in recent years by cognitive psychology, had its beginnings in behavioural psychology[2]. Because of this, many of the approaches can be highly mechanistic and algorithmic and quite difficult to comprehend and apply, particularly for those with limited expertise in the use and applications of technologies to education. An understanding of how students learn and what makes learning possible is obviously of great importance for educators and has implications for media selection.

However, as Laurillard points out,

> it is clearly important to base a teaching strategy on an understanding of learning, but the relationship is fuzzy. The character of student learning is elusive, dependent on former experiences of the world and of education, and on the nature of the current teaching situation.[3]

Similarly, Bates believes that "the appropriate use and selection of technology depends very much on local circumstances: context is all important"[4]. He also comments further on the decision-making process. Although his remarks relate to open and distance education, they are equally applicable to all methods of educational provision:

> Decision-making about technology in open and distance learning is a complex process, requiring consideration of a great number of factors. Decision-making in this area is also about personal choice, driven as much by values and beliefs as by technical considerations. These different factors cannot easily be related to one another quantitatively. In the end, an intuitive decision has to be made, but based on a careful analysis of the situation.[5].

Note
This decision-making framework constitutes a first draft only. All comments and suggestions are welcomed. Please submit these to Vis Naidoo at the Department of Education.

Bates suggests that "decision making should be based on an analysis of questions that each institution needs to ask"[6]. He groups these questions under the following criteria:

- Access: how accessible is a particular technology for learners? How flexible is it for a particular target group?
- Costs: what is the cost structure of each technology? What is the unit cost per learner?
- Teaching and learning: what kinds of learning are needed? What instructional approaches will best meet these needs? What are the best technologies for supporting this teaching and learning?
- Interactivity and user-friendliness: what kind of interaction does this technology enable? How easy is it to use?
- Organisational issues: what are the organisational requirements, and the barriers to be removed, before this technology can be used successfully? What changes in organisation need to be made?
- Novelty: how new is this technology?
- Speed: how quickly can courses be mounted with this technology? How quickly can materials be changed?[7]

This chapter contains a framework which is designed to assist educators, educational managers, and educational administrators to make decisions about the introduction and use of technologies. The tool facilitates a process of making decisions which is based, to some extent, on the contextual, situational elements that Bates and Laurillard have identified, but also, to a large degree, on intuition and common sense. The need to answer the types of questions posed by Bates has been used as a starting point for developing this decision-making framework, although the tool itself uses a very different set of organizing principles.

2. USING THE DECISION-MAKING FRAMEWORK

Refer to page 11 to see principles and to page 55 to see guidelines.

The members of the investigation team were, however, particularly concerned that the tool should reflect, both in structure and in content, the principles outlined in chapter one of this report and the guidelines listed in chapter three⇦. Consequently, various efforts have been made to ensure that the tool is as flexible as possible. The tool itself has been divided into various modules, each of which has been designed as a self-contained unit. This has been done to allow different starting points for people, depending on their needs. Two suggested pathways through the tool, together with various 'scenarios', are outlined in the next section, but the team members hope that even these will be modified or changed according to the needs of the user.

Refer to page 129 to see appendix A.

In addition, to keep the tool as simple as possible, several questions of detail have been moved into the background, being placed in Appendix A of the report⇦. Thus, the questions contained in this chapter are broad ones focused on particular elements of the teaching and learning environment and the introduction of technologies to that environment. Cross-references are then supplied where more detailed questions on a particular issue are available in Appendix A. Appendix A contains full, detailed versions of the Teaching and Learning Environment Module and the Module on Integrating Technologies into the Teaching and Learning Environment. Users can either work through the abbreviated modules contained in this chapter, and refer to the

Appendix only if they feel unsure about a specific question or issue or if they wish to add detail to certain answers. Alternatively, they can turn to the Appendix and work through the entire tool.

As has been suggested, the intention has been to create a flexible management tool. Thus, it is envisaged that people will modify the tool, adding questions or simply ignoring those questions which they feel are irrelevant to their particular context or choice of technology. Despite this, however, the team does feel that certain questions posed do need answers if effective decisions are to be taken about which technologies to introduce into education and training programmes. Consequently, those questions which the team feels definitely require answers are marked in Appendix A with a symbol - ☑ - and are typed in **Garamond Bold Font**. It is, however, also recommended that users read through all the questions, even if they do not answer them.

The decision-making framework consists of four modules. Each will be discussed in turn, although it should be stressed that this does not represent a chronological order in which the modules should be completed. The four modules are:

- The Teaching and Learning Environment Module.
- The Technologies Module.
- The Module on Integrating Technologies into the Teaching and Learning Environment.
- The Costing Module.

These modules could be completed either for:

- a programme, which can be defined as courses which are organized and administered together because they have a common focus (which might be type of qualification, the particular community being served, the teaching medium used, the subject matter, the level at which the courses are taught, or other similarities).
- a course, which can be defined as a systematic course of learning with measurable exit performance standards which is part of a larger programme of study.

2.1. TEACHING AND LEARNING ENVIRONMENT MODULE⇨

Refer to page 77 to see this module.

The primary aim of this module of questions is to enable decision-makers to develop a picture of the teaching and learning environment in their planned or existing educational programme. To facilitate this, the teaching and learning environment has been broken up into various components (represented graphically in figure one), although it must be stressed that this is a highly artificial separation. Education and training are complex social processes, in which the various components are intertwined in many ways, often creating difficult tensions. Nevertheless, it is necessary to consider each component part in attempting to paint a picture of the whole environment.

In terms of Bates's categories outlined above, this module covers several of the ***teaching and learning*** issues and covers a broad range of ***organizational*** issues. Consequently, it will develop an understanding of the teaching and learning environment essential for calculating ***costs***.

Figure one is a graphical representation of the teaching and learning environment; it can be applied to any teaching and learning context using any methods of educational provision. Each element is described in detail.

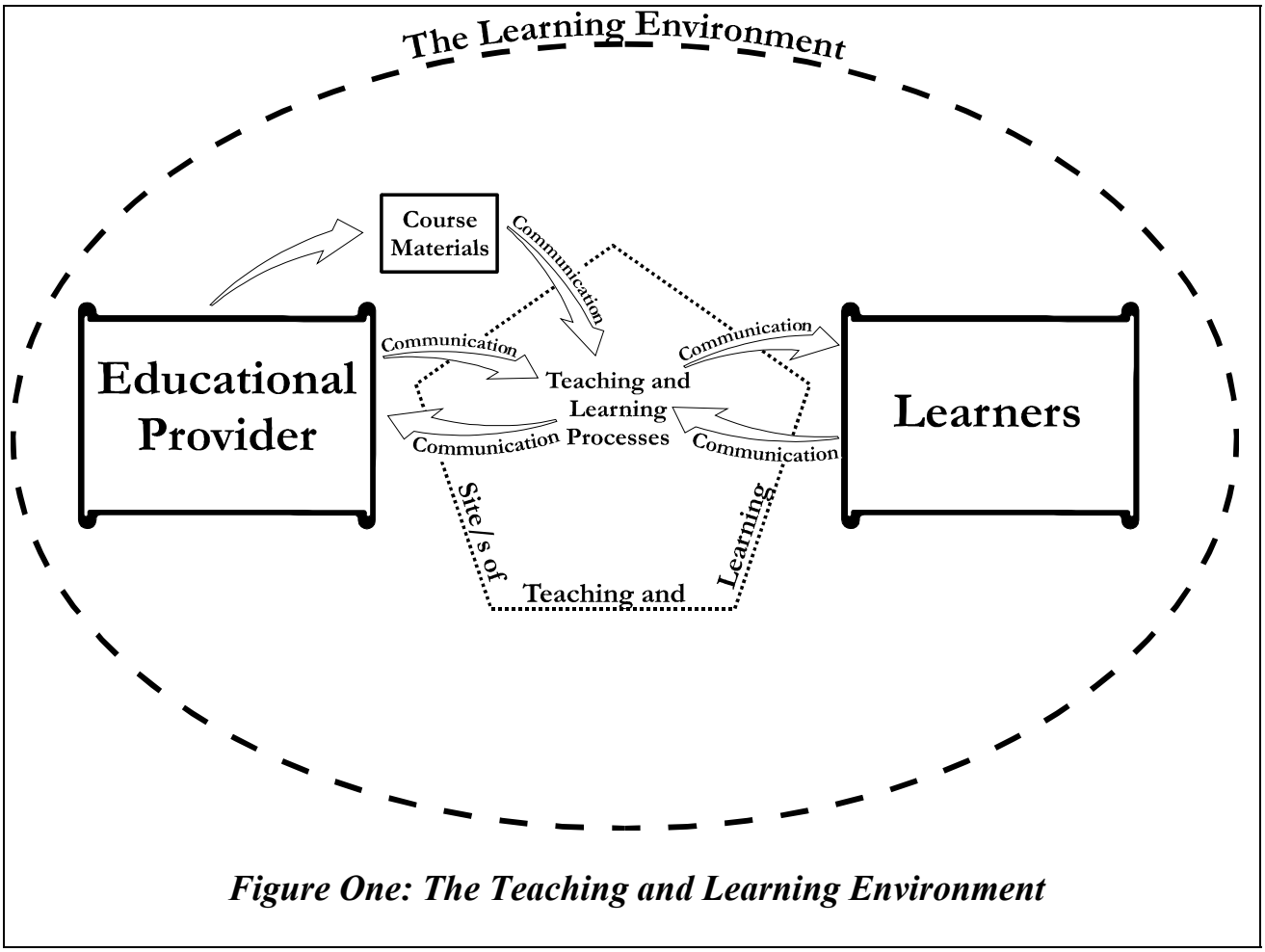


Figure One: The Teaching and Learning Environment

- ***Learners***

As the broad principle of learner-centredness starts to gain credence in South African education and training, it becomes ever more important to be aware of the features of the group or groups of learners for which a planned or existing programme is intended. Developing an understanding of the target group/s of learners in the teaching and learning process and their circumstances is essential in the planning or updating/amending of any educational programme. As part of this, it is vital to focus on the learning objectives of the programme, developing an understanding of the programme's curriculum. These issues are included here because the development of the curriculum should focus on the needs of the learners. It is also important to look broadly at the needs of a range of organizations relevant to the learners, for example employers and community organizations. This also ultimately affects the developing picture of the learners' needs in very important ways.

- ***Teaching and Learning Processes***

The design of any course will involve a combination of teaching and learning processes, whether they be structured or not. These will be based on different educational approaches (for example, content mastery, skills mastery, drill and

practice, problem solving, exploratory project work, or applied knowledge-based) and methodologies (for example, learner-centred, teacher-centred, peer group and team work, or constructivist). Most, but not all, teaching and learning processes will be planned by the educational provider during course design and development. These processes involve an interface or engagement between the learners and the educational provider, using a range of activities, strategies, mechanisms, and techniques. The focus of teaching and learning processes is to achieve the stated objectives of a particular course, regardless of what those objectives are. A few examples of teaching and learning processes would be tutorial sessions, lectures, practical work, peer group discussions, watching videos, working through study guides, assignments, and examinations. It is essential to develop an understanding of the teaching and learning processes planned in educational courses in order to choose technologies to support them.

- ***Communication***

All education and training involves processes of communication between the educational provider and the learners, and it is essential to develop an understanding of the modes of communication most appropriate to a particular teaching and learning process. Any teaching and learning process consists of combinations of these kinds of modes of communication, which in turn support the teaching and learning strategies and activities of a particular course. This communication can either be one-way or two-way, depending on need. Communication can take place in various ways:

- face-to-face, for example, in classes, tutorials or practical sessions;
- via correspondence, whether it involves post, courier, fax, or electronic mail;
- using printed media of various kinds, which can either be distributed via correspondence or in face-to-face sessions;
- using audio such as radio, audio cassettes, telephone calls, or audio conferencing;
- using video, for example, one-way broadcasting, video, or video-conferencing;
- using computers and computer-based multi-media, whether they be stand-alone or part of a network.

- ***Course Materials***

Often, in processes of making decisions about which communications technologies to use to enhance teaching and learning, there is insufficient consideration of the need to have high quality course materials to be used with these technologies. This problem is discussed in greater detail in chapter five⇨, but the team has felt it necessary to develop a separate section on course materials to draw attention to the need to consider course materials design and development issues in some depth, particularly as resource-based learning approaches⇨ become more familiar in South Africa.

Refer to page 105 for more information on course materials design and development issues.

- ***Sites of teaching and learning***

All teaching and learning strategies and activities take place at one or more ‘sites’. Conventionally, people have tended to equate sites of teaching and learning with schools and universities, but the development of more flexible approaches to education and training is gradually making it clear that there are multiple sites. These would include schools, universities, colleges, and technikons, but would also include community centres, the home, the workplace, and a range of other physical

Refer to page 275 for more information on resource-based learning.

locations. Any education and training programme could involve teaching and learning strategies and activities at more than one teaching and learning site. It is vital to know the sites at which teaching and learning will take place, because the physical infrastructure available at these sites will influence the choices of technologies. For example, there is no point in developing a distance education programme which requires students to work on computers if the majority of students will not have access to computer facilities at home or at a local learning centre.

- ***Educational Provider***

Internationally, the term 'educational provider' is coming to be understood as the whole structure offering programmes in any sector of education and training. This structure might be an educational institution, a consortium of organizations, a private business, a non-governmental organization, or a government department. The description of the educational provider in any educational programme would, therefore, include the following elements:

- Finances
- Educators
- Curriculum design and development
- Course materials design and development
- Student counselling (pre- and in-programme)
- Technical support
- Professional development strategies
- Quality assurance strategies
- Marketing

The educational provider has been included last in this description because the description of the educational provider will depend very much on the descriptions of the other elements of the teaching and learning environment.

Refer to page 82 to see this module.

2.2. TECHNOLOGIES MODULE⇦

The aim of this module is to give decision-makers information about the range of technologies available which can enhance education and training. This information covers the range of technologies available, infrastructure required to introduce the technologies, some indications of the costs of the technologies (but not of the associated costs of introducing them into teaching and learning environments, which depends on a range of variables), and discussions about some of their strengths and weaknesses. Using this information, decision-makers would be expected to make some preliminary decisions about which technologies, if any, they would like to use to enhance their planned or existing education and training programme. These technologies could be used in one of two ways; to support teaching and learning strategies and activities or to support the administration and management of the teaching and learning environment (see figure two below).

The team has focused on providing information on communications technologies only, and not on the full range of specialist technologies, such as laboratory equipment or engineering technologies. This has been due to limitations of time and the fact that the brief suggested a need to concentrate on communications technologies. Mention is,

however, made of these specialist technologies, which cover a vast spectrum of technologies. The team envisages that information on these technologies would be gathered over time during the information-gathering processes outlined in chapter five. Decision-makers wishing to introduce specialist technologies to enhance teaching and learning strategies and activities are, therefore, encouraged to undertake their own research about those technologies (filling in the categories of information outlined above) and to use it to answer the questions in the Module on Integrating Technologies into the Teaching and Learning Environment. This valuable research work could then be incorporated into the developing bodies of 'indigenous knowledge' which emerge from certain initiatives outlined in chapter five.

In terms of Bates's categories outlined above, this module answers questions on the ***novelty***, and ***speed*** of technologies. In addition, however, it provides information essential to answering questions about ***access*** to and the ***costs***, and ***interactivty and user-friendliness*** of technologies.

Figure two indicates where decision about the use of technologies will need to be taken, by indicating what the place of technologies within the teaching and learning environment is. Thus, reading the Technologies Module should be done with this figure in mind.

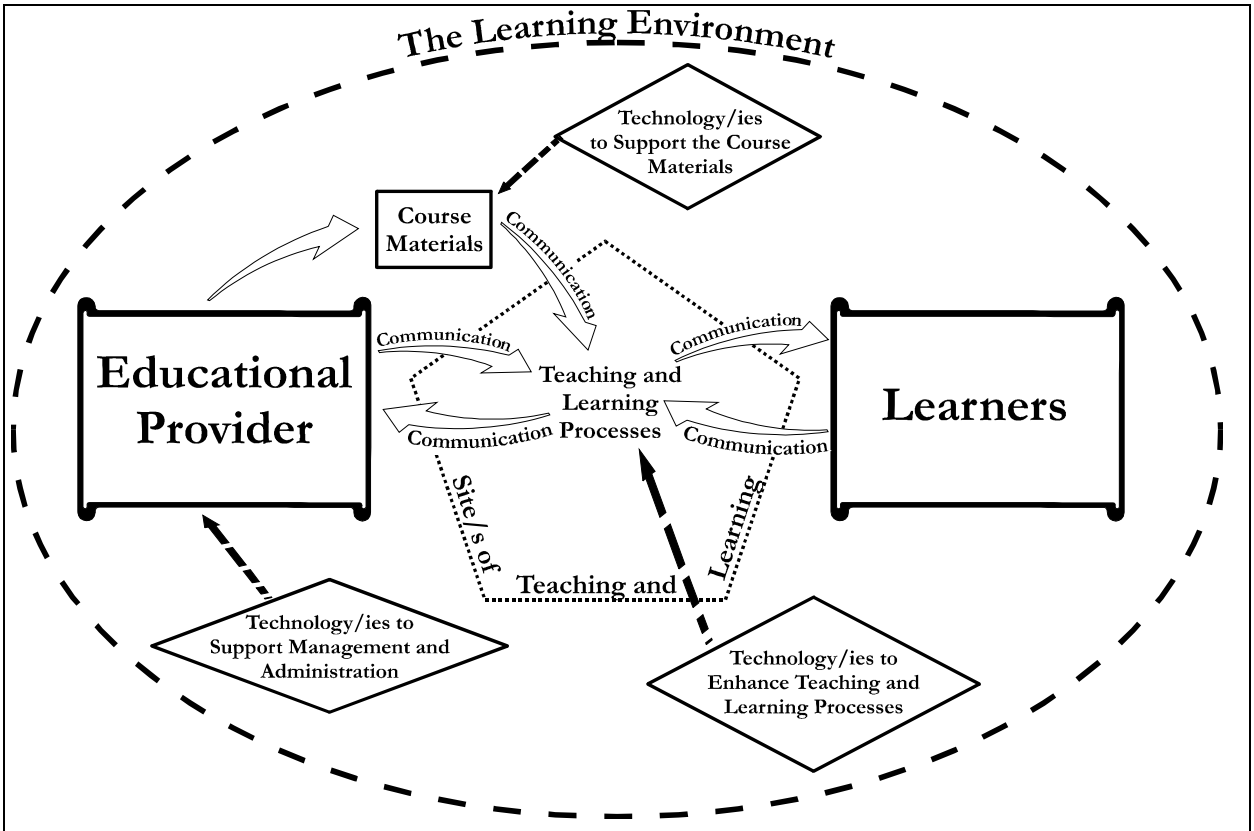


Figure Two: Integrating Technologies into the Teaching and Learning Environment

Refer to page 87 to see this module.

2.3. MODULE ON INTEGRATING TECHNOLOGIES INTO THE TEACHING AND LEARNING ENVIRONMENT⇦

The purpose of this module is to take decision-makers through a set of questions which will help them to understand the implications of introducing certain technologies into the teaching and learning environment (represented graphically in figure two). The ability to develop useful answers to the questions will depend in part on accessing information about particular technologies using the Technologies Module. In addition, however, several of the answers will depend very much on the needs and circumstances of the educational provider and of the learners, as well as on the specifics of chosen teaching and learning sites. Consequently, the module also depends very much on developing a clear understanding of the teaching and learning environment using the Teaching and Learning Environment Module. The answers to the questions posed in this module should lead to a refined understanding of the teaching and learning environment when certain technologies are used to enhance it.

In terms of Bates's categories outlined above, this module will answer questions relating to ***access*** to and the ***costs*** and ***interactivty and user-friendliness*** of technologies.

Refer to page 89 to see this module.

2.4. COSTING MODULE⇦

When deciding which technologies to use to enhance education and training, it is essential to understand the financial implications of introducing a particular technology to a teaching and learning environment. The most effective way of doing this is to calculate the costs of the teaching and learning environment before or without the introduction of the chosen technologies and then to calculate the costs (or savings) of introducing technologies into that teaching and learning environment. Using answers to questions in the Module on Integrating Technologies into the Teaching and Learning Environment, it will also be possible to reflect on the educational implications (positive and negative) of introducing these technologies. For maximum benefit, it would be ideal to run comparative costing processes on different combinations of technologies. Together, these processes would make it possible to determine, with a fair degree of insight, the cost benefits of investment in the selected technologies.

Note
For ease of reading, some of the questions have been written as if they are aimed only at new or existing programmes. Each can, however, be answered in either circumstance.

3. SUGGESTED PATHWAYS THROUGH THE DECISION-MAKING FRAMEWORK

People making decisions about which technologies to use to enhance education and training will be doing so in one of two basic circumstances⇦:

- While planning a new educational programme;
- While planning to modify and enhance an existing educational programme. In this case planning might be taking place either specifically to introduce technologies to enhance the programme or might form part of a broader formative evaluation of the effectiveness of the programme.

The tool contained in this chapter has been designed with both circumstances in mind, and, in each, the basic process remains the same. This is because it remains important when modifying an existing educational programme to develop a clear understanding of the current teaching and learning environment before deciding on which technologies to use to enhance it. Consequently, the questions for both decision-making processes will remain the same, as will the possibilities for taking different pathways through the tool.

One of the key guiding principles for using technologies to enhance education and training put forward by the investigation team has been the need to make decisions which are driven by the needs of learners and related educational concerns and not by choices of technologies. It is, therefore, vitally important to develop a clear understanding of the teaching and learning environment in a planned or existing educational programme before deciding which technologies to use. The investigation team is, however, aware that educational decision-makers by no means live in a perfect world, where it is possible to consider the needs of learners and related educational concerns before being faced with the dilemma of certain technological choices. Very often, decision-makers are confronted with technological choices before they have had an opportunity to consider educational issues in any depth. This may happen, for example, as a consequence of political pressures placed on decision-makers or sales pitches made by technology vendors⇨.

Refer to scenario four below (page 75) for an example of a decision-maker confronted with a technological choice before having considered educational needs in depth.

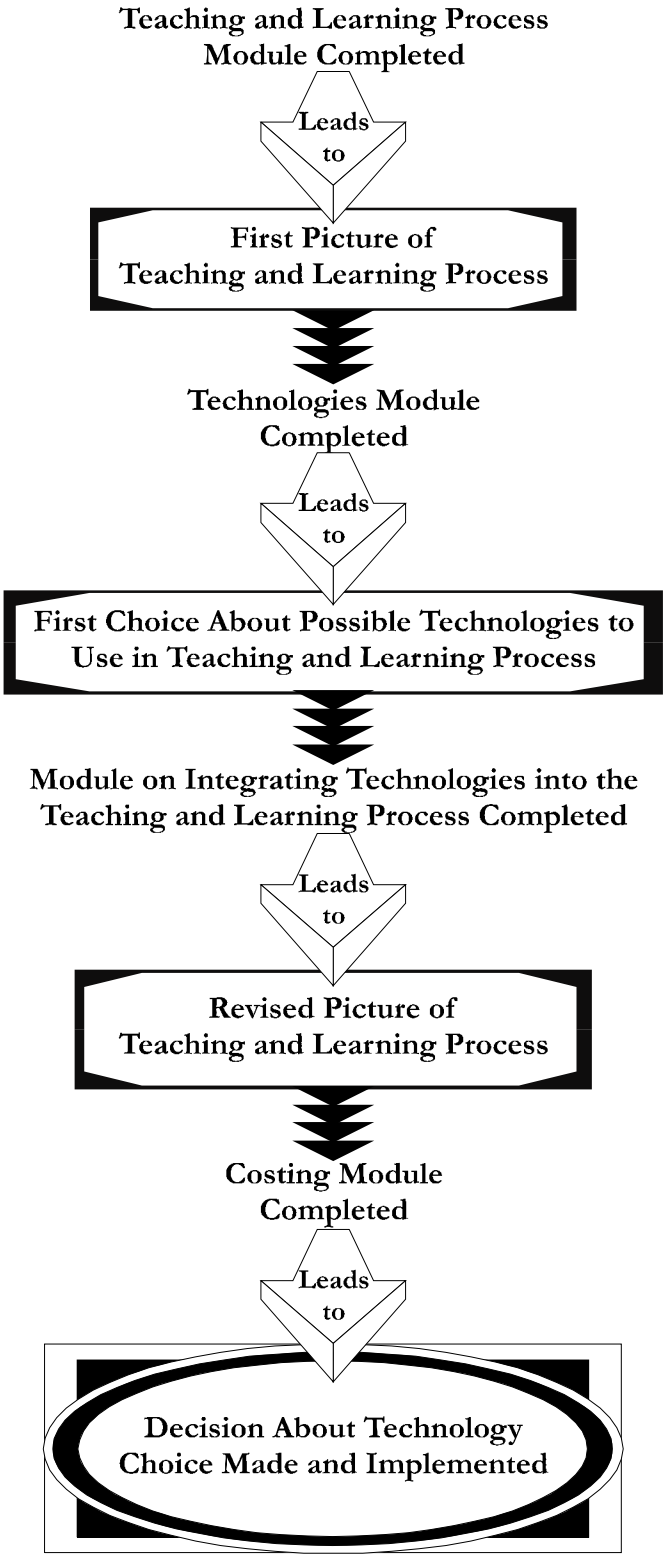
This understanding has driven the efforts of the team to develop a tool which can be applicable in a range of circumstances. To explain the team's understanding of different possible circumstances, two different pathways through the tool will be described briefly. There may be others. It will take time, thought, and preparation to work through this Decision-Making Framework. Users may wish to explore the questions in a workshop or individually. Because decision-making in technology-enhanced learning is a rigorous, time-consuming process, time needs to be set aside to complete the exercise. This is particularly important when decisions involving large numbers of learners and amounts of money are involved.

3.1. PATHWAY ONE: PROACTIVE PLANNING

Refer to page 77 below to start on this pathway.

Using this pathway, the starting point for decision-makers⇨ would be the planning of a new education and training programme or the improvement of an existing one. There is little or no pressure being placed on them by technology vendors or political circumstances to make immediate choices about technologies. Thus, they are able to work through the modules in the pathway outlined in figure three. Three scenarios are given with this pathway to indicate how the tool might be applied.

Figure Three: A First Pathway Through The Framework



SCENARIO ONE: THE TECHNICAL COLLEGE

Jo Bloggs is a teacher in a technical college/ trade school teaching first year carpentry and joinery students. Each year, she must teach students how to use and maintain woodworking hand tools such as planes, chisels, and saws. She demonstrates the skills and techniques required at the beginning of the course but finds that she must repeat these demonstrations many times during the year. Deciding there must be a better way to teach these skills, she consults the media development unit in her college. She meets the media development officer and together they consult the TELI Decision-Making Framework. After going through the questions in the Framework, they decide that the best medium to demonstrate the manipulation skills required is video. The TELI information clearing-house indicates that there are some commercially available videos, but they are quite lengthy. Having gone through the questions in the Framework, Jo feels that these videos do not suit the learning needs and learner characteristics of his students. She does not have any budget for video production, but the College does have some portable video production equipment and video editing facilities. Jo and the media development officer plan a series of 3-5 minute videos which use the simple portable video equipment to record her demonstrating the skills in the carpentry and joinery workshop. The media development unit edits the footage and produces a series of video programmes to Jo's specifications. In a corner of the workshop, Jo sets up a small learning station where the videos and an accompanying, already written set of booklets are stored and where a video recorder and monitor are located. For security reasons, this equipment is bolted to a bench with secure-fast bolts. With each new class, Jo still does an introductory demonstration session to introduce each tool. She then shows the students the videos and encourages them to view these at any time when they require a further demonstration of the skills. The approach works so successfully that Jo plans another series for her second year students on operating machine tools. A number of Jo's colleagues teaching in other colleges hear about the approach and ask her for permission to use the videos and reproduce the study guides for their own teaching programme.

SCENARIO TWO: PROVINCIAL DEPARTMENT OF EDUCATION

A provincial department of education is concerned about the level of training of primary school teachers, particularly in the rural areas of the province. It proposes to provide some professional development to practising primary and secondary teachers in rural areas who have had little or no teacher education. Although many of these teachers are already enrolled in teacher education courses offered at a distance, there is some concern that these courses do not reflect new educational aims which prioritize a democratic education and the development of critical thinking abilities. The department consults with a local teachers' college that is engaged in the national process of developing a curriculum that reflects more modern thinking and educational practice. A decision is made to plan and develop an introductory module that will not only introduce teachers to a new approach to teaching and learning, but will model the approach as well. The department and the college work through the questions in the Decision-Making Framework and decide that some well-designed print materials which could be delivered as part of a distance education programme would be a cost-effective solution to their problem.

The department and the teachers' college form a partnership with a distance learning institution and this consortium develops some attractive course materials. To support these materials, a number of regional workshops are held to introduce teachers to the concepts contained within the materials. It had been established when the Teaching and Learning Environment Module of the Framework was completed that, because of the isolation of some schools, many teachers will not be able to attend these workshops. To overcome this, a number of radio programmes are produced in conjunction with the education branch of the regional SABC station. These programmes are designed to support and reinforce both the print materials and the workshops. They include interviews and real life experiences of teachers working in the area. These broadcasts are also made available on audio cassette at local community centres. The print materials include a guide for teachers to assist them in keeping a journal of their teaching activities which reflect the new skills which they are developing. This journal will be accepted by the teachers' college for credit towards an award for these teachers wishing to continue further studies.

SCENARIO THREE: NON-GOVERNMENTAL ORGANIZATION (NGO)

An NGO has responsibility for coordinating adult basic education and training (ABET) programmes for a number of organizations and institutions around South Africa. For a number of years, it has been developing, producing, and providing print materials for these programmes to support basic literacy and numeracy, life skills, and issues related to democracy, health, and education. Although there are institutions, schools, and study centres running these programmes, they are not reaching many isolated communities in rural areas, townships, and squatter camps. Research has, however, indicated substantial need in these areas. The NGO has some funding from an aid agency to extend the reach of its activities, but more importantly to stimulate discussion and raise community awareness about some of the issues outlined above.

SCENARIO THREE (CTD)

By working through the TELI Decision-Making Framework, the NGO develops a clear idea of learner needs, characteristics, and circumstances. These indicate low levels of literacy and high levels of poverty. A sample survey shows that many of the people whom they are hoping to reach do not have access to television and that some of them do not have access to a regular electricity supply. Most of them do, however, have access to radio and listen to it regularly. A number of them have access to the new clockwork radios, thus overcoming the need for electricity or batteries. These devices are proving to be most popular particularly in rural areas. A decision is therefore made to produce a number of radio programmes, and agreement is reached with regional and local radio stations to broadcast the programmes as a community service. The programmes are produced in a number of languages and, to a large extent, based on real life issues using interviews with local people. They deal with topics of relevance to the communities being served. Follow up and supporting information is made available in booklets which are supplied to regional and local centres running ABET programmes. In addition, because many of the listeners do not have access to these centres, the material is also made available in a number of regional and local newspapers. The radio programmes prove so popular that many of the study centres tape them and use them as part of their ABET programme. A number of institutions also find that the outreach ABET programmes that they are attempting to run are enhanced and the student drop-out rate is diminished with the introduction of the radio component.

Refer to page 87 below to start on this pathway.

3.2. PATHWAY TWO: RESPONDING TO PROPOSALS⇦

The above pathway indicates processes of decision-making in a relatively pressure-free, proactive planning environment. However, as all educational decision-makers are well aware, there is very often pressure placed on them to accept, or buy into, certain technologies. This pressure can cause decision-makers to make choices about technologies before placing them into the context of the broader teaching and learning processes in which they will be used. Quick decisions often seem most appropriate in the short term, but generally have very negative financial implications in the medium to long term, as the failure of many technology-enhanced learning initiatives indicates. As Tony Bates notes,

> The history of education is littered with the corpses of technology-based projects that were killed because of the high operating costs, problems of adaptation to local conditions, lack of skilled personnel to operate the technologies, and lack of effectiveness[8].

In an effort to support decision-makers under this type of pressure, the team has constructed a second pathway through the decision-making framework. It is sketched out in figure four, and accompanied by two scenarios.

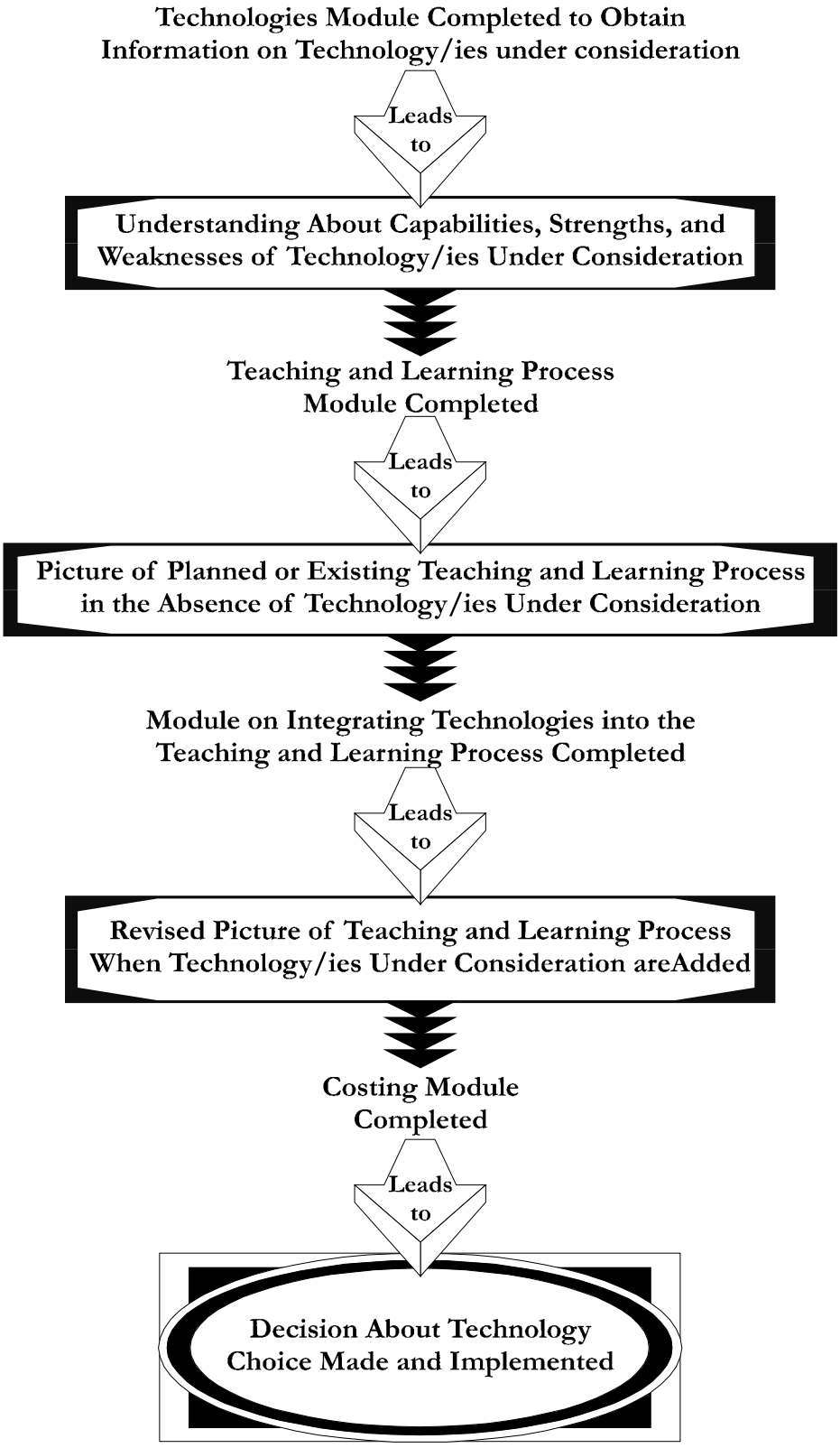
SCENARIO FOUR: SCHOOL

A major computer company approaches the Bulamakanka High School and offers them twelve new computers for their computer laboratory, which has yet to be equipped. There are no strings attached, but the principal suspects that they are old models which are no longer marketable by the company. The regional director is very keen for the school to accept this gift as he is under some pressure because of the current poor state of technology in his region. The principal and the teacher in charge of the school's computer programme look for information on the capacity of the computers using the Decision-Making Framework.

Guided by the Framework, they consider the following kinds of issues: how the technology will be used; maintenance requirements and its availability; compatibility of the computers with other computer systems; security issues; professional development needs arising from the computers.

As a result of answering these kinds of questions, they are able to conduct a costing exercise on the acceptance of the computers. This places them in a much better position to decide whether the gift is acceptable or whether they could be stuck with a white elephant.

Figure Four: A Second Pathway Through The Framework



SCENARIO FIVE: NATIONAL DEPARTMENT OF EDUCATION

The Department of Education is approached by three technology vendors, each of which is trying to sell its particular technology for use in higher education institutions. Each vendor claims that its technology can provide innovative solutions to the problem of making higher education opportunities available to far larger numbers of students at substantially reduced unit costs. The Department is wary of what appears to be substantial initial investment in all three options, but is also aware that there is considerable pressure to 'massify' higher education opportunities at costs affordable to marginalized social groups.

The Department, however, has limited personnel in higher education, and cannot afford to test each option by taking it through the Decision-Making Framework. Instead, therefore, the three vendors are invited to submit tenders, using the Framework as the organizing method for the tenders. The Department indicates that the proposals submitted should, as a minimum, contain answers to those questions regarded as questions which have to be answered to make effective decisions. On the basis of these tenders, which are put together within two weeks of the invitation, it selects one initiative for more detailed investigation. It puts together a team of five consultants, who are experts in planning and evaluation, course and programme design, technology selection, instruction and learner support, and professional development and information respectively. They investigate the selected initiative more thoroughly, using the Decision-Making Framework, in order to investigate whether or not the technology can bring significant cost benefits in higher education institutions. This enables them to decide if the investment is worthwhile or if it is likely only to lead major expense and yield little of educational value.

[1] Bates, A. 1995, Technology, Open Learning and Distance Education, London, Routledge, p. 33.
[2] See:
- Reiser, R. and Gagne, R. 1983, Selecting Media for Instruction, Englewood Cliffs, NJ, Educational Technology Publications.
- Romiszowski, A. 1988, The Selection and Use of Instructional Media, London, Kogan Page.

[3] Laurillard, D. 1993, Rethinking University Teaching: A Framework for Effective Use of Educational Technology, London, Routledge, p. 70.
[4] Bates, A. 1995, Technology, Open Learning and Distance Education, p. 59.
[5] *ibid*, p. 59.
[6] *ibid*, p. 1.
[7] *ibid*, pp. 1-2.
[8] .Bates, A.W. 1991, "Media and Two-Way Communication in Distance Education" in Distance Education: A Developing Method, Norwegian State Institution for Distance Education/NKI, p. 1.

4. TEACHING AND LEARNING ENVIRONMENT MODULE⇨

Refer to page 65 to see the introduction to this module.

Refer to page 131 to see the full version of this module.

Refer to page 64 to see the section on using this Decision-Making Framework.

1 If you are following pathway one, this module will be your starting point. It will help you to paint a first picture of the teaching and learning environment in your planned programme or course. Please read through the section on using this Decision-Making Framework before starting⇨.

2 If you are following pathway two, this module follows on from the Technologies Module (which starts on page 82). Use the questions to develop an understanding of the teaching and learning environment in your programme or course as it is currently being run (i.e. WITHOUT the technology you are thinking of introducing).

Use this module to develop a preliminary understanding of the different components of the teaching and learning environment, whether it be in a planned or existing education and training programme.

Refer to page 66 to see figure one.

The aim of the module is to develop an understanding of the following components of the teaching and learning environment (as developed in figure one⇨):

- Learners
- Teaching and Learning Processes
- Communication
- Courseware
- Teaching and Learning Sites
- The Educational Provider

Each group of questions contributes to an understanding of an element of the teaching and learning environment. It is recommended that you answer each group of questions on a separate sheet of paper. In this way, it will be possible, if desired, to recreate figure one visually, using the answers to the questions below. This might be done by sticking the individual sheets of paper on a large wall or board.

WHO ARE THE LEARNERS? (QUESTION 1 IN THE FULL MODULE)

- Can the learners be identified as a discrete, homogenous group, or are there significant differences between them? (Question 1.1 in the full module)
- How old are the learners? ? (Question 1.2 in the full module)
- What is the educational background and learning experience of the learners? Describe the educational experience which learners bring to their learning situation. (Question 1.3 in the full module)
- Why are the learners doing this programme or course? (Question 1.4 in the full module)
- What is known of the personal circumstances of the learners? (Question 1.5 in the full module)
- Do learners have specialized needs or demands that must be met? (Question 1.6 in the full module)
- What counselling might these students require (both before and after enrolling on the programme or course)? (Question 1.7 in the full module)

WHAT ARE THE OBJECTIVES AND CURRICULUM? (QUESTION 2 IN THE FULL MODULE)

- What are you attempting to teach and communicate in this programme or course? What are the stated outcomes? (Question 2.1 in the full module)
- Are the stated objectives consistent with relevant curricular, assessment, and qualifications frameworks at regional and/or national levels? (Question 2.2 in the full module)

WHAT ARE THE TEACHING AND LEARNING PROCESSES? (QUESTION 3 IN THE FULL MODULE)

The answers to these questions will develop an understanding of the teaching and learning processes required to achieve (or which are currently achieving) the stated objectives of a course. If this decision-making framework is being completed for a programme, these questions will need to be answered for each planned or existing course in the programme.

- What approaches, and what methodology/ies will (or do) underpin the course? (Question 3.1 in the full module)

- What time period is the course expected to run over (give a figure in weeks)? If the time period is open, simply make a note of this. (Question 3.3 in the full module)

- What combination of teaching and learning processes⇨ will be employed (or is currently being employed) to achieve the stated learning objectives? (Question 3.4 in the full module)

- How do these processes help to achieve the stated objectives of the course? (Question 3.4.2 in the full module)

- How do they take due account of the needs of the learners? (Question 3.4.3 in the full module)

- How do they reflect the methodologies and approaches you identified above? (Question 3.4.4 in the full module)

- Estimate the number of hours the average learner is expected to spend on these processes to complete the course successfully. Divide it by the number of weeks the course is expected to last and compare it with the estimated number of hours available to learners. How do the figures compare? (Question 3.6 in the full module)

- In which language/s will (or do) the teaching and learning processes take place? How familiar are learners with this language? Is provision made for people who speak different languages? (Question 3.8 in the full module)

Refer to page 66 for a description of teaching and learning processes.

WHAT ARE THE METHODS OF ASSESSMENT? (QUESTION 4 IN THE FULL MODULE)

- Which of the processes outlined above are intended to assess the progress of the learners? (Question 4.1 in the full module)

- To what extent will (or do) the selected or prescribed assessment methods measure the achievement of the stated objectives of the course? How? (Question 4.2 in the full module)

- Are they recognized within relevant qualification frameworks? Which of them are prescribed by an outside body? (indicate which body) (Question 4.5 in the full module)

WHICH MODES OF COMMUNICATION ARE REQUIRED (OR CURRENTLY USED)? (QUESTION 5 IN THE FULL MODULE)

- List the modes of communication required for (or currently used in) each teaching and learning process identified, and describe the features of each mode of communication. (Question 5.1 in the full module)

- Which of the communication modes requires the involvement of an educator? Why? Identify the type of educator required (for example, teacher, facilitator, tutor, mentor, or lecturer) (Question 5.2 in the full module)

- Which of the communication modes involves communication through some form of course material? Why? (Question 5.3 in the full module)

WHAT TYPES OF COURSE MATERIAL ARE REQUIRED OR CURRENTLY USED? (QUESTION 6 IN THE FULL MODULE)

- In developing an understanding of the modes of communication required to support your teaching and learning processes, you will have identified a need for various course materials. List those teaching and learning processes which require course materials of some kind. (Question 6.1.1 in the full module)

Refer to the tables in the technologies module below (page 84) for an understanding of media.

- Which medium (text, video, audio, or digital⇦) or combinations of media is it essential to use in these course materials? Why? (Question 6.1.2 in the full module)

NOTE: These are the only questions about course materials at this point, because several of the questions on course materials will depend on choices of communications technologies. More detailed questions on course materials are contained in the Module on Integrating Technologies into the Teaching and Learning Environment.

WHAT ARE THE TEACHING AND LEARNING SITE/S? (QUESTION 7 IN THE FULL MODULE)

The different processes identified in question 3 all take place in different teaching and learning sites. This set of questions will enable you to develop a better understanding of these sites. Again, if this decision-making framework is being completed for a programme, these questions will need to be answered for each planned or existing course in the programme.

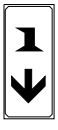
- Where will (or do) the planned teaching and learning processes take place? Describe, in general terms, the types of site or sites of teaching and learning which learners will (or do) use, both for group and individual work. (Question 7.1 in the full module)

- Which of these sites is currently available to learners, at no extra cost (either to them or to the educational provider)? (Question 7.2 in the full module)

- Which of these sites requires renting out of facilities? (Question 7.3 in the full module)

WHAT ARE THE FEATURES OF THE EDUCATIONAL PROVIDER? (QUESTION 8 IN THE FULL MODULE)

- What funds are available to support this programme or course? (Question 8.1 in the full module)
- Describe the educators currently available and/or required for this programme or course. (Question 8.4 in the full module)
- Describe the counselling currently available and/or required for this programme or course. (Question 8.5 in the full module)
- Describe the curriculum design and development staff and mechanisms, if any, currently available and/or required for this programme or course. (Question 8.6 in the full module)
- Describe the course materials design and development staff and mechanisms, if any, currently available for this programme or course. (Question 8.7 in the full module)
- Describe the management and administration systems and mechanisms currently available and/or required for this programme or course. (Question 8.8 in the full module)
- Describe the technical support staff, if any, currently available for this programme or course. (Question 8.9 in the full module)
- Describe the quality assurance strategies and mechanisms (including evaluation strategies and mechanisms) currently available and/or required for this programme or course. (Question 8.10 in the full module)
- Describe the professional development strategies and mechanisms currently available for staff involved with this programme or course. (Question 8.11 in the full module)
- Describe the marketing strategies and mechanisms currently available and/or required for this programme or course. (Question 8.12 in the full module)
- Describe the physical facilities currently available for the management, administration, and marketing of this programme or course. (Question 8.13 in the full module)



Organize the answers to all of the above questions so that they are easily accessible and move on to the Technologies Module (which starts on page 82) now if you are following pathway one.

Organize the answers to all of the above questions so that they are easily accessible and move on to the Module on Integrating Technologies into the Teaching and Learning Environment (which

starts on page 87) now if you are following pathway two.

Refer to page 68 to see the introduction to this module.

Refer to page 64 to see the section on using this Decision-Making Framework.

5. TECHNOLOGIES MODULE⇦

If you are following pathway one, this module follows on from the Teaching and Learning Environment Module (which starts on page 77).

1

If you are following pathway two, this module will be your starting point. Please read through the section on using this Decision-Making Framework before starting⇦.

2

The Technologies Module provides information on a range of technologies available to enhance education and training. The bulk of this information is contained in appendix B. The module, however, provides a grid providing factual information on the full range of technologies which can support different modes of communication in education and training, and the educational providers, designed to facilitate choices about the most appropriate technologies to select.

Table one makes a distinction between 'media' and 'technology'. The Concise Oxford Dictionary defines medium as "the means by which something is communicated (the medium of sound; the medium of television)". Technology, on the other hand, is defined as "the application of science through the use of tools". Thus technology may be highly sophisticated or very basic, new or old. Technologies can be combined with one another, and incorporated into teaching and learning processes in many ways. Bates also differentiates between media and technology by describing the term 'medium' as

> a generic form of communication associated with a particular way of representing knowledge. Each medium not only has its own unique way of presenting knowledge, but also of organising it, often reflected in particular preferred formats or styles of presentation.[i]

Thus, for example, the medium of video may be delivered by a variety of different technologies such as broadcast television, satellite, cable, or video cassette. Table one gives an indication (and not a comprehensive overview) of some of these issues.

Table two below provides a further means to assist you in the decision-making process. It presents a brief overview of the information contained in appendix B.

1 If you are following pathway one, use table two to decide which technologies you would like further information on, and then use the page references to find that information. Your choice will be influenced by your answers to questions in the Teaching and Learning Environment Module. In particular, consider:

- available funding (question 8.1 in the Teaching and Learning Environment Module);
- the teaching and learning processes you have chosen (question 3);

- the modes of communication you have indicated you need to be able to support (question 5);
- the media your course materials need to be able to support (question 6);
- the physical infrastructure available at your teaching and learning sites (question 7);
- the management and administration mechanisms and systems you need for your programme or course (question 8.8).

If you are following pathway two, use the references in table two to guide you to more information on the particular technology which you are considering introducing to the teaching and learning environment.

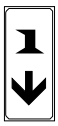
Table One: The Relationship Between Media and Technologies[ii]

Medium	Technologies for Delivery	Educational Applications
Face-to-face contact	• Overhead projectors (manual or electronic) • Specialist technologies • All of the below	• Seminars, tutorials, classes, workshops, and lectures • Learner study groups or self-help groups • Conferences • One-to-one interaction, either between educator and learner, learner and learner, or learner and mentor (especially in workplace) • Drama-in-education or theatre-in-education sessions • Practical demonstration and activities
Text (including graphics)	Print	• Books, booklets, and pamphlets (either already published or written specifically for a course) • Study guides, written either as stand-alone material or as 'wrap-around' guides to already published material • Workbooks intended for use in conjunction with other media materials (for example, audio or video cassettes or computer-based learning) • Newspapers, journals, periodicals, newsletters, and magazines • Printed learner support materials (for example, self-tests, project guides, notes on accreditation requirements or other aspects of courses, bibliographies, and handwritten/typed materials or comments passing between learners and educators) • Maps, charts, photographs, and posters • Written/printed correspondence (including post, facsimile, courier, and electronic mail)
	Computers	• Electronic databases • Electronic publishing (for example world wide web hypertext documents, FTP or ASCII documents) • CD-ROM interactive books
Audio	Audio Cassettes	• Audio programmes
	Radio	• Educational programmes (including talk-back radio)
	Telephone	• Telephone tutoring • Telephone conferences
	Computing	• Multimedia sound • Voice communication
Video	• Television Broadcasting • Cable television • Satellite television (including narrowcast educational television)	• Programmes • lectures
	Video cassettes	• Instructional material • lectures • language teaching
	Video discs	• Instructional material (for examples, art pictures or biological photographs)
	Video conferencing	• Video conferences • point-to-multi-point classes with interactive video and audio
	Computers	• Videographics • See-You-See-Me Conferences

Table Two: Summary of Technologies

Technologies	Multiplexing	Electrical Supply	Telephone	Security	Internet	Medium Supported	Reference Page in Appendix B
Facsimile	Point-to-Point Point-to-Multipoint	Yes	Yes	Yes	No	Text (including Graphics)	**191**
PC/Computer	Stand-Alone Point-to-Point Point-to-Multipoint Multipoint-to-Multipoint	Yes	Yes	Yes	Yes	Text (including Graphics), Audio, Video	**195**
Radio	Point-to-Multipoint	Preferably	No	Yes	No	Audio	**232**
Video-conferencing	Point-to-Point Point-to-Multipoint Multipoint-to-Multipoint	Yes	Yes	Yes	Possibly	Text (including graphics), Audio, Video	**234**
Telephone conferencing	Point-to-Point Point-to-Multipoint	Preferably	Yes	Yes	No	Audio	**187**
Television	Point-to-Multipoint	Yes	No	Yes	No	Audio, Video	**237**
Print	Stand-Alone Point-to-Multipoint	No	No	No	No	Text (including Graphics)	**246**
Overhead projector	Stand-Alone	Yes	No	Yes	No	Text (including Graphics)	**184**
Specialist Technologies	Stand-Alone	Possibly	No	Possibly	No		**248**

If you are following pathway one, move on to the Module on Integrating Technologies into the Teaching and Learning Environment (which starts on page 87) now.

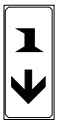


If you are following pathway two, move on to the Teaching and Learning Environment Module (which starts on page 77) now.

6. MODULE ON INTEGRATING TECHNOLOGIES INTO THE TEACHING AND LEARNING ENVIRONMENT⇨

Refer to page 70 to see the introduction to this module.

Refer to page 157 to see the full version of this module.



If you are following pathway one, this module follows on from the Technologies Module (which starts on page 82). You should now have an understanding of teaching and learning environment you are planning and a sense of the technology or technologies you wish to integrate into that environment. Use these to answer the questions below, and add the answers to the appropriate answers from the Teaching and Learning Environment Module. This should give you a refined picture of the teaching and learning environment, after the introduction of the technology/ies.

If you are following pathway two, this module follows on from the Teaching and Learning Environment Module (which starts on page 77). You should now have an understanding of the technology or technologies you are thinking of using to enhance you programme or course. In addition, you should have a picture of the current teaching and learning environment of your programme or course. Use these to answer the questions below, and add the answers to the appropriate answers from the Teaching and Learning Environment Module. This should give you a refined picture of the teaching and learning environment, after the introduction of the technology/ies.

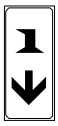
- What use do you intend for the technology/ies you have chosen? (Question 1 in the full module)
- What effect will the technology/ies have on the learners? (Question 2 in the full module)
- Will the technology/ies support the teaching and learning processes of the course or programme as required? (Question 3 in the full module)
- Will the technology/ies support the administration, management, and marketing of the course or programme as required? (Question 4 in the full module)
- What effect will the technology/ies have on the educators? (Question 5 in the full module)
- What effect will the technology/ies have on management and administrative staff? (Question 6 in the full module)

- What are the physical infrastructure requirements for this technology? (Question 7 in the full module)

- What are the maintenance requirements of this technology/ies? (Question 8 in the full module)

- What specific course materials are needed if you use the technology/ies? (Question 9 in the full module)
  - How will you design and develop the course materials you wish to use with the technology/ies you have chosen? (Question 9.2 in the full module)
  - Describe the course design and development processes you believe will be necessary to produce, or adapt, the materials you require. (Question 9.3.1 in the full module)
  - How much will it cost to make available the required course materials to use this technology/ies effectively in your course? (Question 9.4.1 in the full module)

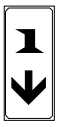
Whether you are following pathway one or two, you should now be in a position to move on to the Costing Module (which is located on page 89)



Refer to page 70 to see the introduction to this module.

Refer to page 166 to see the full version of this module.

7. COSTING MODULE



Whether you are following pathway one or two, you should now be in a position to calculate the costs of your programme or course. Using answers to questions from the Module on Integrating Technologies into the Teaching and Learning Process, you will be able to see what it will cost to introduce the combination of technologies you have selected into your teaching and learning environment. This should be compared against the potential benefits that you envisage that combination of technologies bringing to your teaching and learning environment. This will assist you to decide whether or not the investment is worthwhile.

For purposes of comparison, it might be valuable to select two combinations of technologies and run both through this module and the Costing Module. That will enable you to compare the cost benefits of different options.

Appendix A contains a table that provides a more detailed breakdown of the types of costing considerations which should be undertaken for your course or programme. This *pro forma* can be used for comparing costs and performances of different combinations of technologies introduced into the teaching and learning environment. The intention is that information would be entered only against those line items that are relevant. For example, if there is no formally accredited course involved or if curriculum development and accreditation have already occurred before the current programme or course began, then these areas of activity would not generate costs for the current or planned programme or course.

Identified costs would include both

- direct or 'above-the-line' costs (i.e. costs for which there is a specific outlay of funds)
- imbedded or 'below-the-line' costs (i.e. costs that are, in effect, hidden due to their having been met from other sources, usually recurrent budgets. A typical example is the recurrent salaries of permanent staff who devote time to the programme in question).

The point of filling in the *pro forma* is to answer the following basic questions. The answers to these questions should be based on the many answers you have given to questions in the Teaching and Learning Environment Module and the Module on Integrating Technologies into the Teaching and Learning Environment. Refer back to these answers to calculate costs on each element of your programme or course.

1. What are the estimated costs of your course or programme, with the combination of technologies you have selected?

1.1. What are the front-end or setting-up costs?

[These would include the costs of any hardware or facilities required, of staff development, and of development of support materials.]

1.2. What are the recurrent costs of the programme, both for low numbers and high numbers of learners?

[These would include staffing costs, administration costs, communication costs (which would include the costs of postal services, telephone and fax links, electronic mail, and any applicable costs for transmission or broadcasting), costs of learner support (offered both face-to-face and at a distance), and costs for the regular revision of course materials.]

1.3. What are indirect recurrent costs, particularly those borne by the learners and educators (including costs of travel or of time taken off work)?

1.4. What are the comparative costs for other courses or programmes which could achieve the educational goals and outcomes identified for this course or programme?

[This question provides an easy opportunity for evaluators to affirm the value of their programme, particularly if they do not earnestly consider various technologies and methods of provision but only choose those which will undoubtedly be less cost-effective than their own.]

2. Having calculated the estimated costs of the course or programme with the combination of technologies. Ask yourself the following questions:

2.1. Which of these costs have been incurred as a direct result of introducing the selected combination of technologies?

2.2. What are the educational benefits of introducing this combination of technologies? Do these justify the expenses?

2.3. What are the expected student numbers over the life of the course? Do these numbers justify the potential costs, particularly if there are high initial capital expenses? If these costs are high, can they be amortized over a number of years, so that the unit cost per student over the expected life of the course or programme is cost-effective?

On the basis of these answers, you should now be in a position to make a decision about whether or not to invest in the chosen technologies for your planned or existing course or programme.

[i] Bates, A. 1995, Technology, Open Learning and Distance Education, p. 31.
[ii] Adapted from Bates, A. 1995, Technology, Open Learning and Distance Education, p. 30.