MAKING APPROPRIATE EDUCATIONAL TECHNOLOGY CHOICES: A SOUTH AFRICAN PERSPECTIVE

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PREFACE

A common problem facing many education decision-makers is to make appropriate choices about use of educational technologies to support curriculum delivery. Very often, these choices are driven more by technological imperatives than they are guided by sound educational choice.

In this paper, Neil Butcher argues for the importance of carefully considering a range of educational principles and lessons before making educational technology choices. He also stresses the importance of ensuring that educational imperatives - not technological preference - drive the integration of technologies into courses and programmes.

The paper draws on significant experience that has been developed in South Africa concerning the use of ICTs to support education and training, attempting to extract some key lessons learned. The purpose of articulating these lessons is not to develop a quagmire of unachievable principles, which effectively prevents action or implementation. Rather, it is an effort to extrapolate essential lessons demonstrated by recent local and international experience in order to ensure that future initiatives build on this experience rather than repeating costly and educationally pointless exercises.

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INTRODUCTION

This paper will attempt to provide a practical perspective on how to harness educational technologies to support education and training. I will begin by reflecting on appropriate approaches to making decisions about the use of educational technologies. I will then attempt to extrapolate some of the most important lessons emerging from the use of technologies to support education and training in South Africa. Finally, I will use the example of online learning technologies to explore possibilities and pitfalls of using technologies in education and training.

EDUCATION AND TRAINING IN SOUTH AFRICA

It is, by now, well documented that one of the key challenges facing South Africa in this period of social change is the need to transform an education and training system which has been ravaged by many years of apartheid educational policy and international isolation. At the same time as the country's education and training system is expected to deal with this difficult process of transformation, however, it is being exposed to many other pressures which it shares in common with all education and training systems around the world. These include: rapid development and convergence in functionality of information, communications, and broadcasting technologies; deteriorating boundaries of nationality and national markets; growing pressure on traditional education and training to provide access to far larger numbers of students, of all ages; a crisis of confidence in traditional approaches to education, which have often confused education with transfer of information; and dwindling funding - in real terms - for education and training purposes in the public sector.

In seeking to find solutions to these problems, many people are exploring the potential role of information and communication technologies (ICTs) in education and training. Unfortunately, however, there is a widespread legacy of failed technological initiatives in South African and world education. Reasons for these failures are many and varied, but include the following:

- Imposition of inflexible technological choices made without reference to educational need and context;
- Lack of investment in integrated curriculum and course design and development processes;
- Integrating technologies into programmes based on poor pedagogical practice (a problem especially acute in South Africa where the legacy of fundamental pedagogics[1] is still so strong);
- Unexpectedly high operating costs, and a very high percentage of total expenditure on recurrent costs, which militates against achieving economies of scale;
- Underestimation of the need for well-developed systems of student support, designed as an integral part of overall courses;
- Lack of attention to designing and implementing effective management and administrative systems; and

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[1] Fundamental pedagogics is a pseudo-philosophy of education that was developed to underpin Christian National Education, which was in turn the architecture of the apartheid education system. The philosophy advocates highly authoritarian, teacher-centred approaches to education.

• Paucity of people with the necessary skills and expertise to staff programmes, and a corresponding absence of clear professional development strategies designed to overcome this problem.

MAKING APPROPRIATE DECISIONS

The above context and challenges have informed at least one policy process of importance in South Africa, the development of policy on technology-enhanced learning. It is relevant to educators less because it is a policy position than because it is a useful resource, which can effectively inform educational practice in a range of ways. It focuses on establishing a policy framework for three types of technology use:

1. *Technologies to support the provision of course materials to learners*
   These technologies are made up predominantly of the wide range of information and communications technologies, right through from the printed book and other printed materials to television and radio to multimedia computers and the Internet.

2. *Technologies to support other teaching and learning processes*
   The provision of course materials is an important part of the teaching and learning processes in all education and training, whether face-to-face or at a distance. In addition, however, many technologies might support other teaching and learning processes. Some of these can be used generally in any education and training programme, such as whiteboards or overhead projectors, while others might be referred to as specialist technologies, such as woodwork equipment or language laboratories. Again, the range of technologies covered by this group ranges from the very simple, such as pen and paper, to the very sophisticated, such as computerized simulators.

3. *Technologies to support management and administration*
   An important use of technologies, often neglected in policy statements, is in support of management and administration of education and training. While some technologies, such as telephones and filing cabinets, have long been used for these purposes, there is a growing understanding that the rapid development of information and communications technologies provide significant opportunities for making savings in this area of education and training and also for leading to more effective management and administrative systems.

The TELI policy process establishes clear commitment to a particular approach to making decisions about using technologies in education and training. This decision-making approach depends strongly on developing a clear understanding of the teaching and learning environment and capabilities of different available technologies before examining the likely impact and cost of integrating selected technologies into the teaching and learning environment. The intention of this approach is to guard against technologically driven educational projects, which, as the document itself points out, invariably do not provide effective or sustainable educational solutions. The decision-making framework contained in the TELI Discussion Document poses interesting challenges for an implementation planning process for any technology-enhanced learning strategy, and provides an

essential starting point for any investigation of the possibility of using different technologies to support education and training.

Bates suggests that 'decision making should be based on an analysis of questions that each institution needs to ask'[2]. 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?[3]

The TELI Report contains a detailed decision-making framework designed to assist processes of deciding which technologies to use, and how best to use them. 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 framework itself uses a very different set of organizing principles. It consists of four components or steps, 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. Each step is discussed briefly.

DEVELOPING AN UNDERSTANDING OF THE TEACHING AND LEARNING ENVIRONMENT[4]

The primary aim of this step in the process is to enable decision-makers to develop a picture of the teaching and learning environment in their planned or existing educational course or programme (including structured and informal educational strategies). 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

[2] Bates, A. 1995, *Technology, Open Learning and Distance Education*, London, Routledge, p. 1.

[3] *ibid*, pp. 1-2.

[4] This overview of decision-making approaches is based on: Ministerial Committee for Development Work on the Role of Technology that will Support and Enhance Learning, 1996, *Technology-Enhanced Learning Investigation in South Africa*, Pretoria, Department of Education. I have developed a full decision-making framework for the Department of Education, which is available on request from its Centre for Educational Technology and Distance Education.

consider each component part in attempting to paint a picture of the whole environment.
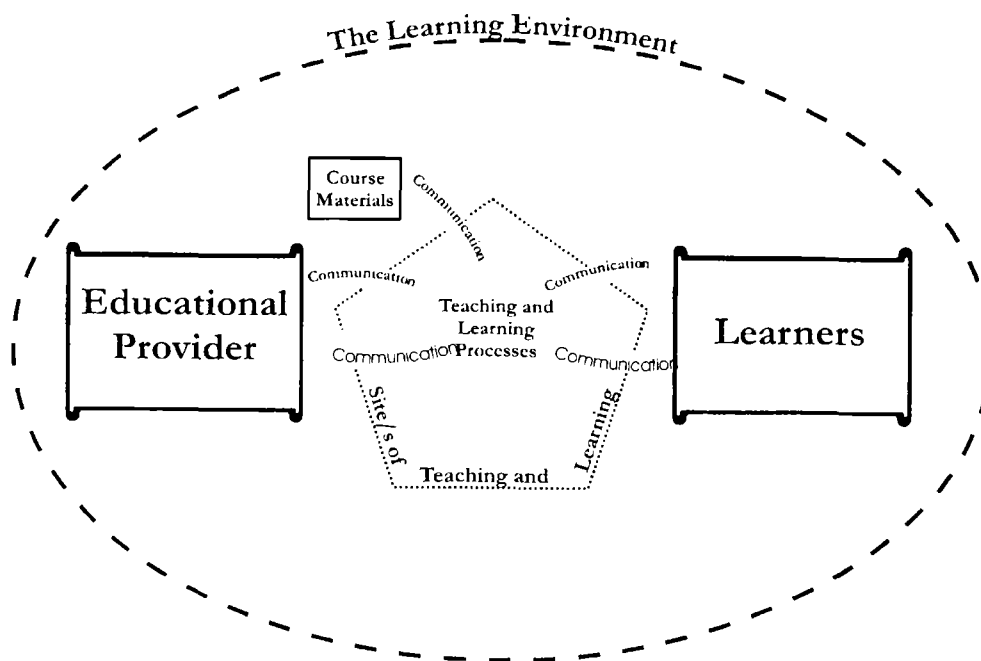
Figure One: The Teaching and Learning Environment

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.

- ***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 educational intervention 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 intervention. As part of this, it is vital to focus on the learning objectives of education and training programmes, developing an understanding of curriculum. These issues are included here because the development of curricula should focus on the needs of 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 learners' needs in 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

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provider during course design and development (whether the educational provider be an institution or the training arm of a large organization). These processes involve an interface or engagement between 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 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, compact discs, 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 learning resources. This problem is discussed in greater detail in the following section.

• *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 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 choices of technologies. For example, there is no point in developing a distance education

programme that 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.
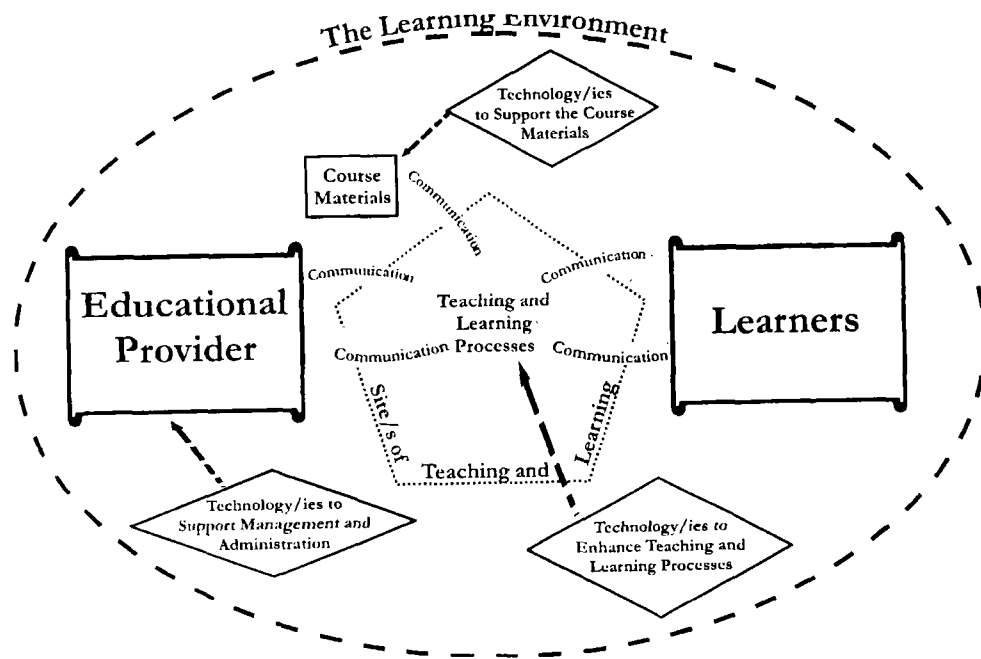
- ***Educational Provider***

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 (or department within a 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;
- Administrative systems;
- Quality assurance strategies; and
- 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.

CHOOSING TECHNOLOGIES

The aim of this step is to gather information about the range of technologies available that 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 HRD intervention. 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.

The Learning Environment

Technology/ies
to Support the Course
Materials

Course
Materials

Communication

Educational
Provider

Communication

Teaching and
Learning
Communication Processes Communication

Communication

Learners

Site/s of

Teaching and

Learning

Technology/ies to
Support Management and
Administration

Technology/ies to
Enhance Teaching and
Learning Processes

**Figure Two: Integrating Technologies into the
Teaching and Learning Environment**

Figure two indicates where decisions about the use of technologies will need to be taken, by indicating what the place of technologies within the teaching and learning environment is.

INTEGRATING TECHNOLOGIES INTO THE TEACHING AND LEARNING ENVIRONMENT

The purpose of this step in the process is to develop an understanding the implications of introducing certain technologies into the teaching and learning environment (represented graphically in figure two). The ability to develop this understanding will depend in part on accessing information about the technologies themselves (as noted in the previous step). 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, this step also depends very much on developing a clear understanding of the teaching and learning environment in the first step. The picture developed during the first step is then refined when certain technologies are used to enhance it.

COSTING

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 the understanding developed of the implications of integrating specific 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.

LESSONS FROM LOCAL AND INTERNATIONAL EXPERIENCE

The above approach outlines a strategy for identifying key issues on which the success of any effort to integrate educational technologies into teaching and learning environments will depend. By extrapolating essential lessons demonstrated by recent local and international experience, it may become possible to ensure that future projects build on this experience rather than repeating costly and educationally pointless exercises. Although it runs the risk of becoming over-used, a Tony Bates quotation helps to drive the point home:

> *the history of education is littered with the corpses of technology-based projects that were killed because of the high oprrating costs, problems of adaptation to local conditions, lack of skilled personnel to operate the technologies, and lack of effectiveness.*[5]

Despite the wealth of experiences both locally and from around the world on which this country can draw in planning and implementing technology-enhanced learning, it appears that we are repeating many of the mistakes that have been made in such initiatives. Thus, South Africa does not yet appear to be 'leapfrogging' mistakes made around the world as was hoped would happen, but seems rather to be emulating those mistakes. Consequently, below I present some ideas that could usefully be taken into account to overcome these problems, at least in part. The discussion below is neither intended to be a blueprint for successful technology use nor a comprehensive overview of reasons for failure. Rather, I have tried to isolate some of the key issues on which successful use of technologies by educators will depend.

RATIONALE FOR DISTANCE EDUCATION AND RESOURCE-BASED LEARNING

Most educational initiatives seeking to harness the capacity of educational technologies - and particularly ICTs - are, in some way or another seeking to draw on distance education and resource-based learning methods. For this reason, it is worth reflecting briefly on the rationale for exploring resource-based learning and distance education methods. Whether consciously or unconsciously, attempts to make use of distance education methods and resource-based learning by various educators in South Africa over the past few years have been driven by a desire to build on some or all of the following lessons emerging from the respective histories of distance education and resource-based learning:[6]

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[5] 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.

[6] It would, of course, be naïve to believe that the motivations of all educators introducing resource-based learning and distance education methods are educationally driven. Many

1. Distance Education

1.1. Providing access to students who would - either because of work commitments, geographical distance, or poor quality or inadequate prior learning experiences - be denied access to traditional, full-time face-to-face education opportunities.

1.2. Seeking to expand access to educational provision to significantly larger numbers of learners.

1.3. Shifting patterns of expenditure to achieve economies of scale by amortizing identified costs (particularly investments in course design and development and in effective administrative systems) over time and large student numbers.

2. Resource-Based Learning

2.1. Breaking down the traditional notion that a teacher talking to mostly passive students is the most effective strategy for communicating curriculum.

2.2. Directing a significantly larger proportion of total expenditure to the design and development of high quality resources, as a strategy for building and assuring the quality of educational provision.

2.3. Implementing strategies to shift the role of the educator. Draft government policy statements on the use of technologies in education and training summarize this changing role as follows:

- They will become facilitators and managers of learning in situations where they are no longer the source of all knowledge.
- They will plan, negotiate for, and manage the integration of learning in formal institutions, in the workplace, and in communities.
- Many educators may spend a considerable proportion of their workloads contributing to the preparation of courseware.
- Many will interact with learners at a distance through any one, or any combinations, of a variety of media (of which real-time face to face interaction is only one of many possibilities).
- Preparation, management, and logistics will vary greatly between the following modes of communication:
  - remote interaction with individual learners;
  - presentation of one way television or radio broadcast;
  - video conference that hooks up a number of remote sites;
  - written response to a learner's assignment; and
  - face to face facilitation.
- It will be essential that educators design and administer complicated, increasingly computer-based record-keeping systems that keep track of learners' progress through their individual learning pathways, pathways that reflect individual variations in learning content, learning sequence, learning strategies, the learning resources, media and technologies chosen to support them, and the pace of learning.
- Increasing proportions of educators' work will involve them as members of teams to which they will contribute only some of the required expertise,

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organizations and individuals in South Africa are using certain distance education methods and cheap versions of resource-based learning to increase student numbers and/or income with little or no concern for impact on the quality of that educational provision.

and of which they will not necessarily be the leaders, managers, or coordinators.

2.4. Investigating the potential that the integration of new educational technologies into teaching and learning environments has for supporting, improving, or enhancing those environments.

TECHNOLOGICALLY-DRIVEN EDUCATIONAL SOLUTIONS DO NOT WORK

As the range and complexity of technologies available to support education and training rapidly expand, the reality that technologically-driven educational solutions do not work has been repeated almost to the point that it has become a cliché. Despite this, however, the continued failure of technology-based projects (many of which were based in South Africa) has demonstrated clearly both how valid this principle remains and how difficult it is to implement in practice. As was noted in the TELI Report, when examining trends in the use of technologies in education and training in South Africa:

> In most cases, decisions about what technology to use in the learning environment were made on the basis of the technological preference, rather than by determining which technology was most suitable for the learning objective.[7]

Consequently, the following pointers are worth taking into consideration.

- *Educational principles and issues have to form the foundation of decisions about what technologies to use and how.* There has long been an apparent tension between the agendas of technology providers and good educators, which has often resulted in failed educational initiatives. Technology providers have tended to focus on 'getting things done' and fast rollout of plans, while good educators, realizing the contextual and immensely complicated nature of education, have tended to implement plans slowly and thoroughly, continually reflecting on the quality of what they have done. However, it is possible to exploit the creative possibilities of this tension, using them effectively to overcome weaknesses inherent in each approach.

An effective way of achieving this is to work closely with identified educators who have built up a reputation for providing high quality education, using this as a base from which to explore possible roles for the technologies available. In this way, there is a far greater likelihood - but obviously still no guarantee - that educational principles and issues will form the foundation of decisions made, even though exploration of the potential of particular technologies provides the ostensible starting point. In doing this, it remains essential to bear in mind that, although principles can quickly be reduced to cliché or jargon, it is necessary to

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[7] Ministerial Committee for Development Work on the Role of Technology that will Support and Enhance Learning, 1996, *Technology-Enhanced Learning Investigation in South Africa*, p. 39.

take very seriously the difficulty of implementing idealistic educational principles in practice.

Underestimating the difficulties in successfully implementing principles such as those which form the basis of South Africa's white paper on education and training will surely lead to repetition of mistakes made elsewhere. Simultaneously, however, these principles do provide a solid basis for taking forward the effective transformation of South Africa's education and training system. Thus, simply ignoring the principles when they prove difficult to implement is also not a solution. Unfortunately, the only solution is to go through rigorous, thorough processes of planning, implementing, and evaluating initiatives in a sustained effort to give expression to the educational principles fundamental to current South African educational policy.

- Before making any contractual commitment, **test the viability of using the particular technology or technologies for the intended educational purposes by exploring its potential** in a chosen area with the best available educators.

- *Never take marketing jargon at face value.* Always test claims made about technologies and their ability to perform certain educational functions - as well as the ability of a technology provider to deliver according to promise - before assuming their validity.

- *Do not get locked into contractual arrangements that force commitment to a particular technological solution for an extended period.* In all cases, examine ways to 'disinvest' in particular technological choices when they are proving ineffective. Often, political pressure, commitments made up front, and fear of failure cause people to respond to failed use of technologies in education by pouring even more money into a failed initiative. The results of this are generally worse education and greater resource wastage.

- *Ensure that the choice of technology does not lead to imbalances in fixed and variable costs.* As has been indicated above, it can make educational and financial sense to direct significantly larger proportion of total expenditure to the design and development of high quality resources. Similarly, the history of distance education has demonstrated that it is possible to shift patterns of expenditure to achieve economies of scale by amortizing identified costs over time and large student numbers. Often, however, the choice of technologies militates against such use of money, particularly when one intends using expensive technologies (such as satellite broadcasting). This can result in very expensive, but educationally ineffective, provision of learning opportunities.[8]

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[8] There are examples in South Africa of attempts to use satellite technology where the expense of investing in physical infrastructure and equipment, together with the high costs of broadcasting, have encouraged use of the technology simply to broadcast live lectures. On the face of it, this makes financial sense, as it avoids the expense of producing high quality video material. In South Africa, where the legacy of fundamental pedagogics and the

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- Regardless of technological choice (often influenced by intersecting educational, financial, social, political, and economic interests), **ensure that sufficient time for planning, designing, and developing an effective educational programme is scheduled**. This time should not mistakenly be equated with calendar time. Rather, it should be calculated in terms of person time. For example, it is no use setting aside a year to plan and develop a course if there are only one or two people working part-time allocated to this task.

TECHNOLOGIES CAN EITHER BE USED AS A CATALYST FOR TRANSFORMATION OR AS A MECHANISM FOR MAINTAINING THE STATUS QUO

Transforming Educational Practice

Educational discussions about the potential role of new technologies - most recently fuelled by the rapid development of ICTs - have an undeniable ability to generate tremendous interest, enthusiasm, and excitement. This can be seen, for example, in the dominance of new technology as a theme at educational conferences around the world over the past five years. If harnessed effectively, there is a distinct possibility that this might be a very powerful catalyst for transforming dominant education practices, particularly if exploration of possible roles for such technologies is based on cognisance of the points raised above (the nature of a transformed education system is documented in detail in recent policy and research documents). However, a good example of how this possibility can be exploited is in examining ways in which to transform the role of the educator from a teacher to a manager or facilitator of learning processes, in ways that have been described above. This task is sometimes made easier because ICT development and use have contributed strongly to eroding myths of the teacher as the source of all knowledge.

Unfortunately, though, most uses of technologies, both old and new, still tend to enhance the role of the traditional teacher, using new gimmicks as 'high-tech chalk'. The assumption seems to be that the 'talk and chalk' approach is still the most effective way of organizing educational opportunities and that a key function of technologies should be either to enable teachers to do this better or to make his or her lecture available to more students at one time. This trend points clearly to the fact that, despite an often stated commitment to the principle of learner-centredness, attention to the needs and demands of learners is absent from the majority of technology-enhanced learning initiatives, as is any sustained attempt to use learners to construct their own curricula and to participate actively in designing solutions to their learning needs.

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mistaken, teacher-centred notion of education as a process of transmitting information form educators to mostly passive learners, it is also appealing to many people who grew up with this as their only experience of education. When systems based on this logic have become operational, two features are notable. First, the failure of the system to provide an interactive learning environment - even where feedback to the central studio is possible - leads to the introduction of local support in the form of (often poorly prepared) tutors who are present throughout broadcasts. This leaves one with an expensive satellite system and an equally expensive face-to-face system running in parallel. Second, there is a notable absence of fixed investment in educational resources or administrative and management systems that can provide the basis for future programmes. The most common results of this are educational failure, resource wastage, and learner and educator disillusionment.

The dominant approach still tends to be to consider learners as empty vessels to which knowledge must be transmitted, in a largely one-way process of communication, by the teacher. Using this as a starting point, there seemed also to be an unproblematized assumption that the use of technologies, and particularly of newer technologies, is a valuable exercise in itself. In many examples, there is little questioning of the content being provided using these technologies and of how they could most constructively be used to enhance this provision educationally. There is often very little rigorous effort to match choice of technologies to learning outcomes and processes of courses and programmes. There also seems, in many cases, to be a lack of sophistication in mixing media and technologies to achieve learning objectives.

Creating Scaleable Teaching and Learning Models

In cases where people have attempted to use new technologies to transform teaching and learning processes, and to use their ability to support interaction to engage students more actively, this often adds to the work load of educators as it opens new channels of communication between educator and student. There is, of course, no problem with this when educators are willing to cope with that workload because of the benefits it brings to teaching and learning. It does, however, point to problems that are likely to emerge if new technologies are implemented systemically, on a large scale, rather than in isolated case studies and pilot projects. It suggests a need to focus on the importance of the human element in the use of technologies, and this is picked up on below.

Importantly, though, this points to the importance of ensuring that projects integrating the use of ICTs into education and training seek to create learning environments wherein exploration of educational roles for the technologies available can function as a catalyst for effective educational transformation and for building high quality education. It is also necessary - particularly given the scale of particular educational problems and backlogs - to focus on developing teaching and learning models that can be taken to scale cost-effectively. Many 'Pilot Projects' owe whatever success they have to intervention by enthusiastic individuals - who are also often very good educators - determined to make the pilot succeed. This is laudable, but can establish teaching and learning models that are not workable on a large-scale when this type of individual intervention is unable to compensate for weaknesses in such models.

The Gap Between Rich and Poor

It has often been noted that, in general, the development of new technologies is serving to entrench, or even widen, the gap between rich and poor, both between countries and within them. Indeed, it seems that this trend is one of the most difficult with which South Africa has to deal. It is a particularly interesting problem, because the country is located at the crossroads between developed and developing countries, thus providing ideal opportunities for exploring how technologies can be used to achieve equity. It seems, however, that references to the widening gap between the "haves" and the "have-nots" often simply pay lip-service to the problem rather than presenting constructive solutions - involving the use of technologies - to it.

Practical examples of uses of new technologies tend to reinforce the notion that they entrench this gap rather than demonstrating practical solutions to the problem. This is because, in general, they depend on

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students having access to the necessary facilities (sometimes even in the home) rather than being based on an assumption that students' circumstances might prevent them from having access to any facilities. This should not be regarded as criticism of the initiatives, most of which are taking place in developed countries, where such assumptions may, in all likelihood, be quite reasonable. They do indicate, however, that people and countries with large resource bases are much better placed to take advantage of the educational benefits arising from using new technologies in teaching and learning than are people and countries with few resources. This is not an easy problem to solve, but clearly developing countries cannot solve it by pretending that it does not exist. Rather, it is a problem that South Africa has to work through in order to ensure that access to new technologies is opened up to marginalized communities in innovative and cost-effective ways. Above all, not tackling the problem head on is, as much as anything else, likely to be an act of perpetuating economic, and educational, marginalization.

In acknowledgement of these problems, Tony Bates referred - in a keynote address to the Educational Technology 2000 conference held in Singapore in 1996 - to different types of partnerships which might be established between institutions from developing and developed countries and to investment by poorer countries in new technologies through the establishment of hubs located in strategic positions. Conceived and implemented properly, these could form the basis for providing marginalized communities with access to new technologies in cost-effective, and educationally useful, ways. These are proposals of particular relevance to the South African context, and much energy has already gone into exploring the possibilities of developing a network of community centres which might function as the strategically placed hubs referred to above. The TELI Report, for example, refers to the potential role of a network of community centres and to the need for the Department of Education to play a leading role in coordinating its development. This observation should, however, be tempered with comments on the difficulties of establishing community-oriented structures in South Africa provided in the next point.

HIGH QUALITY COURSES AND LEARNING RESOURCES ARE CRUCIAL TO THE SUCCESS OF TECHNOLOGY-ENHANCED LEARNING INITIATIVES

The TELI Report makes the observation that:
Experience from around the world indicates that introducing technological hardware into education and training is generally the easiest part of the process, and often ends up being the cheapest in the long term. The development of course materials to be used with such technologies, whether they be printed resources, video cassettes, or computer-based resources, is a far more costly and time-consuming process, and is also an ongoing one.[9]

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[9] Ministerial Committee for Development Work on the Role of Technology that will Support and Enhance Learning, 1996, *Technology-Enhanced Learning Investigation in South Africa*, p. 96.

Based on this, it goes on to assert that:

The successful introduction of technologies into teaching and learning environments depends on high quality course materials. Unfortunately, however, inadequate attention, time, and money are generally devoted to the design and development of such course materials. In order to change this, it is necessary to redirect significant funds to course design and development processes.[10]

Unfortunately, in many cases where technologies are being used to support or enhance learning, high quality learning materials are conspicuous by their absence. Often, the use of technologies is not accompanied by any materials development processes. This is particularly strange because it seems that this very traditional approach to using technologies to enhance learning adds cost to the teaching and learning process without any particular benefits.

EDUCATION IS A PROCESS OF ENGAGEMENT BETWEEN TWO GROUPS OF PEOPLE; LEARNERS AND EDUCATORS. IF EITHER IS NOT EQUIPPED TO ENGAGE EFFECTIVELY, IT IS UNLIKELY TO SUCCEED

Often, in technology-enhanced learning initiatives, people tend to lose sight of the fact that, regardless of the technologies used to support communication or resource provision, education remains - at its most fundamental - a process of engagement between two groups of people: learners and educators. This is very often seen, for example, in writing about educational technology, where people regularly fall into the trap of attributing human capabilities to certain technologies (for example, suggesting that 'the computer provides learning opportunities' or labelling a particular technology as 'interactive'). In such writing, educators can easily be forgiven for developing a concern that some educational technologists are intent on removing educators from the educational process. Similarly, traditional, teacher-centred approaches to education, which focus primarily on the needs and concerns of educators and educational institutions, have often been characterized by a marked absence of any reference to learners. Thus, in writing where the technologies are described as the 'educator' - but paradoxically the traditional teacher-centred philosophy persists - one can easily be left with comically anomalous descriptions of education that are void of any people.

To succeed, educational projects seeking to harness the potential of ICTs will have to focus clearly on ensuring that both educators and learners are equipped to engage effectively in the teaching and learning that takes place. As the TELI Report notes,

It is essential to develop the human capacity required for technologies to be used effectively in education and training. Of course, this involves the professional development of a range of people organizing and offering educational opportunities, including educators, managers, administrators, and technicians. Importantly, however, it also involves developing the capacity of learners to be able to understand and use technologies, both in

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[10] *ibid.* p. 105.

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the learning environment and beyond it, and to be able to reflect critically on their use of different technologies.[11]

It is vital to incorporate clear strategies to ensure that both educators and learners are equipped with the necessary skills, knowledge, and competencies to engage effectively in any educational project using ICTs. Ideally, these strategies should focus also on ensuring that their ability to use the technologies that they come into contact with during a project extends beyond the scope of the project itself.

PROBLEMATIC PARTNERSHIPS ARE WORSE THAN NO PARTNERSHIP

Much has been made recently of the importance of partnership and cooperation in South African education and training, particularly in a context of limited resources and massive need. Very often, however, the principle of encouraging and fostering partnership and cooperation has been presented unproblematically as something intrinsically 'good'. Much recent educational experience in South Africa has demonstrated unequivocally, however, that establishing partnerships is no guarantee of better educational provision. On the contrary, a partnership established on weak foundations - and between partners with widely differing initial agendas - is much more likely to create impediments to effective educational provision and lead to resource wastage than organizations working in isolation.

The above observation is not a recommendation for abandoning partnerships. Rather, it points the way to identifying crucial ingredients for successful partnership. Amongst others, these would include:

- Building partnerships between organizations and individuals with broadly **similar objectives**. This does not imply that there is no room for differences of opinion or approach to solving problems. Indeed, accommodating difference effectively within partnerships can create much better education. However, when philosophies or objectives are antithetical, partnership is very unlikely to work well.
- Identifying clearly the **contributions of each partner** - and their capacity to deliver accordingly - before beginning work.
- Developing clear, commonly agreed **principles for the operation of the partnership** and strategies for dealing effectively - without creating hostility - with partners who fail to adhere to these principles.
- Appoint a good manager - accepted by all parties - from within the partnership to manage the partnership and to ensure that all partners adhere to the above principles.
- Developing clear, commonly agreed **strategies to ask partners to leave or to enable them to withdraw from the partnership**. This might be necessary if the partnership comes to deviate too far from a partner's own objectives or principles. Perhaps more importantly, it may become necessary in the event of non-delivery by one or more partners. Of course, a partnership should be binding enough not to allow withdrawal simply according to whim and to prevent unfair marginalization of partners. Nevertheless, it would similarly be naïve to assume that partnerships will

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[11] *ibid,* pp. 95-96.

necessarily run smoothly, and that there will be no need to dissolve or change the nature of the partnership prior to completion of tasks.

INTEGRATE QUALITY ASSURANCE INTO PROJECTS FROM THE PLANNING PHASE

Internationally, there is growing recognition that one of the most effective ways of ensuring the continual improvement of educational provision is through the establishment of sustainable internal quality assurance mechanisms. Once up and running, these mechanisms can lead to effective self-improving systems within institutions and educational programmes. They can also function as ongoing motivation and professional development for staff. Of course, as with all such mechanisms, there is no guarantee that their implementation will lead to self-improving systems. Nor can such internal mechanisms fulfil all evaluation functions within an institution or programme. Ultimately, success is dependent on the integrity and commitment of the people who implement and participate in quality assurance processes and on their ability to select processes and evaluation strategies appropriate to the context of the institution or programme in which they are working.

Quality assurance focuses on processes and procedures that cannot, in themselves, ensure quality. The standards set, and the notions of quality upon which such standards are based, are crucial. Especially in education, it is dangerous to reduce quality assurance to a mechanistic process, which is not nurtured and challenged by vigorous debate on the aims of education.

> *While attention to managing processes and procedures is essential for assuring quality in Open and Distance Learning, staff also need a clear institutional vision of what constitutes good quality learning, what conditions foster it, and how to assess it.*[12]

Although processes and procedures are the focus, these need to be based on a negotiated and dynamic set of values and seen in a particular context. Processes and procedures must be conducive to quality of performance by all involved. They are not controls or judgements external to that performance. They can be viewed as the means by which the members of an institution ensure that it becomes a learning organization.[13] This then prepares the organization for any externally initiated quality evaluation.

Projects seeking to harness the potential of ICTs for educational purposes would be well advised to implement quality assurance processes from the outset. The TELI Report, however, noted that most technology-enhanced learning initiatives have tended to add 'on their evaluation at the end of the process instead of building it in from the beginning. This ultimately limited

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[12] Robinson, B. 1995. 'The Management of Quality in Open and Distance Learning', a paper presented at the VIII Annual Conference, *Structure and Management of Open Learning Systems*, New Delhi: Conference Papers, vol. 1, p.107.

[13] Argyris, C and Schon, D. 1978, *Organisational Learning: A Theory of Action Perspective*, Reading, Mass., Addison Wesley.

the usefulness of the evaluations'.[14] It went on to propose the following guiding principle: 'Integrate evaluation and impact assessment into the learning system from the start, and adopt a learning orientation to the use of technology in education and training'.[15]

ONLINE LEARNING: POSSIBILITIES AND PITFALLS

The above approaches and lessons provide an essential platform for making appropriate decisions about how to integrate educational technologies into teaching and learning environments effectively. Hopefully, this has articulated reasonably clearly that successful use of educational technologies is dependent less on the technologies themselves than on ways in which they are used by educators. To illustrate this further, I have chosen to explore further one set of technologies - Internet technologies - by reflecting on possibilities and pitfalls presented by their use in education and training.

The aim of this is expressly not to indicate any preference for these technologies. On the contrary, the above argues the importance of examining teaching and learning environments in depth before choosing which technologies to integrate into those environments. Rather, it reflects an attempt to demonstrate practically some of the analytical processes that may be required during steps two and three of the decision-making approach outlined above. Hopefully, this practical example will provide greater clarity on the kinds of deliberations that are necessary before technological choices are made. Before doing this, though, it is necessary to introduce briefly some of the technologies themselves (although this introduction is almost obsolete as soon as it is written, given the pace of technological development).

WHAT DOES ONLINE LEARNING ENCOMPASS?

Online learning may quite justifiably be regarded as a nebulous concept, made more complicated by the rapid pace of development and convergence of those technologies that support it. Nevertheless, for the purposes of this article, 'online learning' is being used to refer to educational applications of Internet technologies, regardless of whether these are used in an Internet or Intranet environment or if they are simply used within a local or wide area computer network.

The Internet is dynamic and continues to grow. It is commonly referred to as an information highway, and even sometimes as an information super highway (although, strictly speaking, the latter term is erroneous as original visions of an information *super* highway have envisaged telecommunications strategies where the limitations of bandwidth currently plaguing most Internet users fall away). This highway metaphor has, however, been contested because it emphasizes the means of transmission. Burge, for example, perceives the Internet as a loom, thus emphasizing its inter-

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[14] Ministerial Committee for Development Work on the Role of Technology that will Support and Enhance Learning, 1996, *Technology-Enhanced Learning Investigation in South Africa*, p. 39.

[15] *ibid.* p. 58.

connectivity.[16] Whatever metaphor is applied, in simple terms the Internet allows for shared information and communication between computer users. Although it was originally text-based, it now supports transfer of multimedia data, including graphics, sound, video clippings, and text.

For the purposes of this discussion, Internet technologies are used to refer to two basic groups of technologies and applications:

1. Technologies and applications that facilitate resource provision
This refers to Internet technologies that facilitate provision of resources, which can be made up of one or more media. The main technologies in this category are:

- *The World Wide Web (World Wide Web)* is a decentralized repository of information and Internet resources housed on computers connected to the Internet. Information can be posted to the World Wide Web by anyone who can gain - or buy - access to a computer that has been set up to function as an Internet server. Web resources are developed using common languages (currently either Hyper Text Markup Language - HTML - or Java), and can then be accessed by people with Internet access using an Internet Browser. Browsers enable information to be found by clicking on a series of hypertext coloured links (text or images) that connect one document to another. Refined search engines have been developed to find links to sites or host computers that store hypertext documents containing requested information.
- *Telnet* is a service that enables a user to log on to another computer attached to the Internet, by typing *telnet* followed by the *hostname* of the other computer.
- *File Transfer Protocol (ftp)* is a software programme that allows the transfer of files from a remote computer to the computer of an Internet Service Provider and vice versa. Files transferred can either be stored on the Service Provider's computer for access using an Internet Browser or for download (again using the file transfer protocol) to another computer.
- *Gopher* is a text-based search and retrieval system for documents on the Internet.

2. Technologies and applications that facilitate communication
- *Electronic mail (e-mail)* allows the sending of messages or files from one computer to another. There are also chat services, which enable users to communicate in real time by typing in a synchronous fashion.
  - Mailing lists and listservs use e-mail for one-to-many and many-to-many communications. A mailing or distribution list is simply a software function that allows a user to send a message to a pre-determined list of recipients. On a listserv, any message sent to a listserv address is distributed to the entire list of participants (many-to-many). Although listserv messages can be distributed automatically, many discussion groups are now moderated in an attempt to remove junk mail or postings that are irrelevant to the topic under discussion. News groups are public, unmoderated discussion groups to which anyone can subscribe.

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[16] Burge, L (1995) 'Electronic Highway or Weaving Loom? Thinking about conferencing technologies for learning' in *Open and Distance Learning Today*, Fred Lockwood (ed), London: Routledge, pp. 151-163.

- "Chat" and "Talk" allow synchronous communication most similar to a telephone conversation. When 'Talk' is used, two people arrange to be online at the same time and can then view each other's typing on a split screen synchronously, allowing one-to-one communication. With "Chat", each member of a discussion group types in their communication and all other members of the group can see the words on their screen with a tag identifying from whom the text is coming.[17]

- *Conferencing.* Although e-mail only allows for text-based communication, more sophisticated combinations of hardware and software applications can allow for synchronous audio conversation or even limited video-conferencing (for example, C-U-See-Me or NetMeeting).

Most importantly, in terms of the above, the Internet provides opportunities for integrating the functions of resource provision and communication, so that resources can be designed to allow for increasingly more diverse types of interaction if well designed. This trend is set to gain momentum as convergence of information, telecommunications, and broadcasting technologies develops further.

REFLECTING ON EDUCATIONAL USES OF INTERNET TECHNOLOGIES

Given the hype surrounding Internet technologies currently – both generally and in relation to their educational applications - it is worth reflecting on educational possibilities and pitfalls. This discussion is not intended to prefer particular technological solutions, but rather to provide an example of a thought process that could inform decisions about whether or not - and then how - to use particular technologies to support educational provision.

What Are the Educational Possibilities?

Below, I outline some ways in which Internet technologies can potentially contribute to educational interventions. Some refer to the functionality of the technology itself, but none are relevant in the absence of effective processes of course design and development that focus explicitly on harnessing these potential strengths.

1. *Resource Provision.* Beginning with the functionality to provide resources, one of the most immediately obvious strengths of Internet technologies is the capacity to provide immediately up-to-date resources to large numbers of learners easily and relatively cheaply (whether one is using the Web or e-mail technologies). Changes made to resources can become immediately available to students without incurring major additional distribution costs. Likewise, communication resources, such as tutorial letters, can be distributed more often, thus reducing costs of ongoing communication by the educational provider. These trends are already becoming increasingly important in a world where curricula no longer change in cycles of five or ten years (or even longer), but need to be adapted and updated continuously.

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[17] Summerley, G. 1996, *The Potential Benefits of the Internet for South African Schools with Particular Reference to the World Wide Web*, accessed from http://www.cyberschool.com

It should be noted here, however, that the capacity to facilitate quick distribution of resources should not be taken to imply an argument in favour of turning online environments into massive 'electronic textbooks' (although regrettably this appears to be how most web course designers tend to use the technology). There is no evidence to suggest that today's – or tomorrow's - students are going to be interested in simply reading textbooks on a computer screen. Thus, one needs to plan very carefully how to take advantage of this functionality without simply creating electronic textbooks (which most students are simply likely to print out and read in paper form anyway).

As an extension of this, Internet technologies also support use of resources that combine more than one medium. While technical limitations still hamper the use of video resources (unless one is working within a reasonably advanced local or wide area network environment), the ability to create multimedia resources - combining audio, graphics and images, and text - is a tremendous potential strength.

An additional benefit that Internet technologies can brings to designers of online learning resources is the huge resource base that resides on the World Wide Web. In itself, this is of negligible educational value, but, if harnessed effectively by educators, it can become a very useful resource. This might happen, for example, through judicious use of links to resources on the Web or by setting learning activities that demand learners to make their own selective use of this resource base. As an extension, it is worth noting that this benefit can extend to the course design process itself. This resource base can be harnessed to support course design and development itself, regardless of the nature of resources being developed.

2. **Facilitating communication.** The second set of strengths of the Internet is its capacity to support a range of communication strategies, especially easy asynchronous communication between educator and learner and amongst learners. Of course, as people who are familiar with the full range of applications of the Internet will know, technologies such as Chat Rooms or Video Conferencing do allow for live, real-time communication as well (subject to limitations of bandwidth). However, the major new strength of e-mail particularly is the capacity to facilitate ongoing communication at times that are suitable to the individuals continuing the conversation. Thus, students can post queries or ideas to educators, who can then respond at later times. Where appropriate, this communication can be extended to include groups of people rather than just individuals. People who have used e-mail and discussion groups for business or research purposes will know the benefits that this brings – as well as the time it can save by focusing discussion - and these benefits apply equally in education. Of course, this is not intended to suggest that such communication can replace face-to-face contact; however, it can be harnessed very effectively for a range of educational purposes.

3. **Facilitating interaction in resources.** Combining the above, it becomes apparent that Internet technologies can provide educators with

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a range of very interesting opportunities for creating resources that allow learners different levels of interactivity. Of course, this can quite easily be used poorly by educators - as will be demonstrated in the discussion on pitfalls - but it can also lead to the creation of interesting and exciting interaction for learners with educational resources. Again, this is not intended to suggest that such interaction can replace all forms of direct human interaction; however, it can be used to engage learners effectively, creating richer teaching and learning environments. This can be facilitated by creative use of, for example, feedback forms, java applets, pop-up boxes, 'yes-no' and multiple-choice responses, and imaginative use of hyperlinks to guide learners through diverse learning pathways.

For example, in a printed resource, activities integrated into texts are usually immediately followed by some discussion of the activity, often discouraging learners from completing the activity. In a web environment, however, one could require some form of response from learners by developing this discussion about an activity as a response to a feedback form (thus requiring learners to submit some thoughts on the activity before seeing the discussion). To discourage thoughtless answers – and to encourage peer interaction - responses could be automatically collated and generated as an HTML page of student responses. Likewise, 'yes-no' responses could be used judiciously to guide learners down different, but equally relevant, learning pathways. In this instance, the response is used not to provide right or wrong answers, but rather to solicit information from learners on their particular preferences or concerns.

4. **Flexibility.** A concept gaining importance in education generally, and no doubt in HRD specifically, is the notion of flexibility in educational provision. Of course, this raises a range of complex questions and problems, which fall beyond the scope of this article. Nevertheless, Internet technologies and online learning do create new possibilities for introducing flexibility to learners in terms of time, place, and pacing of independent study. Although the merits of this may be debatable in certain educational environments, it is equally clearly a tremendous potential benefit.

5. **Possibilities for achieving cost-efficiencies.** I have placed this point last because it is possibly the most tenuous - although one of the most strongly touted - potential benefits of using Internet technologies. As has been stressed in previous sections, many technology-based educational initiatives have failed precisely because of their expense. This problem can quite easily occur in efforts to use Internet technologies for educational purposes. Nevertheless, if planned carefully and costed thoroughly, the use of these technologies can, under certain circumstances, create possibilities for achieving cost-efficiencies in educational provision.

Building Information Bases
In addition to the above, there is a further important trend worth noting. The rapid growth in functionality of ICTs opens possibilities for building and exploiting information bases in ways that were simply not possible even two

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or three years ago. In particular, the following developments are worth noting:
1. Developments in the digitization of information of all kinds, whether it be text, graphic, audio, or video.
2. Growing functionality of electronic databases, and particularly allowing people to:
   • Store any kind of information in digital format, with corresponding capacity to run increasingly sophisticated data queries on information once it is organized into a well-designed management information system; and
   • Run data queries - and receive the results of these queries - using HTML-based browsers, whether across the Internet or secure Intranets.
3. Exponential growth in the speed of central processing units and storage capacity of computer hard drives, matched with corresponding reductions in the relative prices of this hardware. These developments contribute significantly to functionality of databases, both in terms of quantity of data storage and speed of manipulation of this data.
4. Rapid developments in cheap electronic communication, more and more aspects of which can increasingly be automated. This is further facilitated by convergence in information and communications technologies, which allows communication such as e-mail or fax to work automatically in tandem with information databases if well designed.

Of course, the above sounds, in many ways, like the marketing jargon of information technology suppliers, elements of which have almost been repeated to the point of cliché. Indeed, such is the speed of communication and effectiveness of information technology marketing that, taken on their own, none of the above points necessarily even sounds particularly innovative, notwithstanding their relative novelty as developments.

Nevertheless, hardly any organizations in South African education and training have yet devised strategies for harnessing these trends effectively to the general benefit of education and social development, indicating clearly that their real potential is not yet well understood. Instead, repetition of rhetorical statements about the developmental potential of ICTs soon starts to ring hollow, raising more questions than it answers. Nevertheless, it is worth noting that introducing the notion of an information base is here intended to provide one practical way in which South Africa can seize the opportunity to take practical advantage of the potential of ICTs. This is essential if we are to work towards reversing current trends for the development of ICTs to entrench or widen the gap between developed and developing countries.

A fundamental shift in the value of information is taking place because of the rapid digitization of information and the consequent ease of its dissemination. Historically, information has been regarded as a product, which people were happy to purchase, to the financial benefit of those social structures that controlled and profited from its production and dissemination. While certain types of information will continue to retain value in this traditional way, the vast bulk of information, once it has been developed or collated, now rapidly loses value. Printed catalogues of information become redundant almost as soon as they are printed because this information changes so quickly. Cheaper and easier reproduction and

communication of information constantly reduce the time that 'privileged' access to information provides strategic advantage. Access to multiple sources of information via the Internet is making it increasingly difficult to identify the source of new ideas, while the rapidity with which new information can be circulated reduces the time for which it can be regarded as 'new'.

These changes make it essential to find ways to use information quickly in as many different ways as possible before it loses its value. These need to focus on re-using information in different ways without generating significant additional cost. In order to achieve this, it is necessary to establish effective information systems, which can allow for quick and easy manipulation of information once it has been developed or gathered. It is also advisable from this perspective to incur the minor additional cost of breaking links between gathering or compiling information and communicating it. Although this creates some additional costs initially, these can easily be amortized across the range of options that then become possible for communicating this information or using it to support a diverse range of educational opportunities. In this way, the expense of generating the information can be used much more effectively.

Possibly most importantly, it becomes essential to develop effective strategies for storing information in ways that allow it to be very easily manipulated for future purposes. If information about educational resources, courses, and programmes is stored in a database, it then becomes easily available for future applications. In this way, research can build on growing knowledge bases, rather than repeating basic work already conducted. This can maximize the value of money spent on course design and development or educational research. It can then also - where appropriate - be easily made available via the World Wide Web for access by other researchers in South Africa, thus contributing usefully to developing an effective educational resource and research base in the country. This has the potential spin-off of developing the country's international reputation as a producer - and not just a consumer - of information.

Another point emerging from the above discussions is that increasingly value lies not in possessing information, but rather in developing the skills and capacity to manipulate it effectively for new applications. This indicates clearly the importance of developing management information systems that allow for cheap, easy, and logical storage and retrieval of information. There is added benefit to creating interfaces to information that enable users to engage with certain types of information themselves with little or no intervention by other people. If a simple web interface is added to such a database, it would be possible for educators and learners to select their own search criteria and extract relevant resources very quickly and at no additional cost to an educational provider. This simple search level adds tremendous value as an educational resource. It is also very cost-effective, because changes made to the database are reflected automatically via the web interface. The lengthy processes of writing pages in HyperText Markup Language (HTML) are removed, because most pages can be generated automatically from the database

For all the above to work effectively, though, educational providers will have to invest financial and human resources in:

- Establishing the types and combinations of information needed to support teaching and learning environments, target learners, and strategies for making this information accessible to all learners;

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- Developing an appropriate conceptual framework for a computer-based management information system; and
- Designing an electronic database architecture that can be used to organize, store, and allow for multiple uses of information.

What are the Educational Pitfalls?

Of course, as well as creating possibilities, Internet technologies contain many potential educational pitfalls. Almost inevitably – as with most technologies – most of these are linked to the way in which the technologies might be used (or misused) rather than anything intrinsic in the technologies themselves. The following list outlines some of these pitfalls. It is by no means exhaustive.

1. ***Potential for poor use.*** Although this a really obvious sounding observation, it is nevertheless worth reinforcing that there is as much potential for poor use of Internet technologies as any other educational technology. As has been the case with many technological innovations (such as radio and television), there has been a proliferation of rhetoric about the potential of Internet technologies to provide simple solutions to very complicated educational problems, much of which is generated by the marketing strategies of technology vendors. Of course, as the use of these technologies develops, a more sophisticated, critical understanding and rhetoric will emerge. Nevertheless, in the absence of this, it is currently necessary to remember that Internet technologies offer no magical panacea to educational problems, and can thus be used just as poorly as any other technology. As has been suggested above, they can also either function as a catalyst for educational transformation or entrench existing educational practices.

2. ***Resource design is complicated and time-consuming.*** A second potential pitfall of Internet technologies is that complexities of resource design and development demand time and high-level skills. This problem becomes particularly acute in environments where human and financial resources are limited, and can be further intensified when poor financial planning leads to heavy expenditure in technological infrastructure that, in turn, absorbs budgets for curriculum and resource design and development. This problem is – almost paradoxically - masked by growing ease of use of different technological applications. For example, it is now very easy to generate HTML pages without learning coding, making it much simpler for people to generate their own web sites. This ease of use can easily mask the complexities of the educational or instructional design that is necessary to create effective web resources. This is reflected in the proliferation of online 'educational' material that is little more than reams of text on a screen.

Of course, this problem can be used to advantage if harnessed effectively. This is because these technologies and software applications have lowered financial and skill entry levels for people interested in exploring their educational use, thus enabling well-managed budgets and design processes to invest a greater percentage of expenditure in course design and development. The key to turning this pitfall into a possibility is effective management of resources. It is, however, worth noting that design of online learning resources can be very time-

consuming. Discussion with people who have developed better quality resources, as well as consultation of international research, suggests that ratios of at least 150 to 200 hours of design time to each hour of learning time are not unusual.

3. **Confusing rote response with interaction.** A key benefit that ICTs have brought to the business world is the ability to automate certain rote tasks (such as management and retrieval of data or delivery of communication). Many of these benefits can be harnessed both in the administration and provision of education. However, they carry with them the potential danger that of confusing rote response with interaction. Some educational theorists differentiate between different levels of interaction, with rote response as a very low level of interaction moving up to more sophisticated levels of interaction. While this is perfectly valid, I would argue that rote response and interaction are actually different processes, the former being designed in ways that can actually impede interaction on the part of learners.

In the use of ICTs and online learning, multiple-choice questions and automated responses are probably the most obvious educational activities that tend to encourage rote response. At a more sophisticated level, design of automated learning pathways that 'guide' learners down a single "right" path often also encourage rote response to and simplistic memorization of learning resources. Of course, this is not intended to suggest that there is no place for these educational strategies. In certain working environments, memorization of key information may be essential to successful operations. When, however, this approach becomes pervasive within an entire educational intervention, it starts to become highly problematic, and is likely to place serious limits on the effectiveness of that intervention.

4. **Effective use requires information literacy skills.** One of the features of increasing use of e-mail and the growth of the World Wide Web has been that there is a proliferation of useless information. This raises interesting challenges, and points clearly to the importance of developing effective information literacy skills. Of course, the term 'information literacy' is itself the subject of some debate.[18], Darch, Carelse, and Underwood argue that information literacy has two components. The one is a set of skills which enables users to identify their information problems and needs, find information irrespective of source or medium, and critically evaluate and use the information. The other is understanding a domain of knowledge, so that an information user is able to evaluate the significance of information in relation to a problem in that domain.

In a later article (19 May),[19] Darch states that information literacy is not just a new name for something which we have always done. It is

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[18] Darch, Carelse, & Underwood, 'Higher Education Review, supplement to the *Sunday Independent*, 12th May 1996, p. 8.

[19] Darch, C. 'Higher Education Review', supplement to the *Sunday Independent*, 19th May 1996, p. 9.

more than just a set of skills like being able to access a library catalogue or to understand the limitations of the television news. Darch argues that it implies a self-conscious awareness of the way in which information systems work (including modern electronic systems), of the dynamic link between a particular information need and the sources and channels required to satisfy that need. Developing these types of skills in learners who are going to use online learning environments will be essential to their successful implementation.

5. **User unfamiliarity.** Linked to the above point is the difficulty - particularly in South Africa - that most potential users, both educators and learners, are likely to be unfamiliar with Internet technologies. Of course, this depends on the nature and level of the educational intervention, but it is a potential pitfall that needs to be factored into conceptualizing the use of such technologies. If one peruses existing online learning resources, it quickly becomes apparent how many assumptions have been made about proficiency of use of the technologies that learners are expected to bring with them. Likewise, strategic decisions to develop online learning strategies are usually taken with little or no reference to the capacity of the educators who will be expected to drive these strategies. Consequently, in designing educational interventions using Internet technologies, it is always necessary to take account of the levels of expertise o educators and learners, and to ensure that appropriate levels of capacity are developed as part of the intervention. This, of course, has the spin-off benefit of developing important new skills.

6. **Technical constraints.** Technical constraints still pose very serious concerns in the use of Internet technologies in South Africa. At a first level, it is necessary to consider carefully whether or not potential learners are likely to have access to the necessary technological infrastructure to be able to participate in online learning activities. These would include access to both the necessary computer systems and to appropriate telecommunications infrastructure. If they do not, investing extensively in online learning could be very wasteful. At a second level, it is essential to design online learning resources that take cognisance of likely levels of computer and telecommunications infrastructure. For example, designing graphics-intensive resources or using video clips when learners are accessing these resources using slower dial-up modems across copper cable is likely only to create frustration and disillusionment. Likewise, using advanced java applets, Dynamic HTML, or HTML-coded e-mail messages is pointless if most learners will have access to computer systems that cannot support fourth-generation web browsers and communication packages.

7. **Uncertainty around copyright issues.** A minor, but important, point to note is that online learning often raises uncertainty around copyright issues. Although it is debatable as to how long copyright will remain a relevant concept as more and more information is digitized, it is certainly still a reality. Thus, one still needs to be careful about not breaching copyright when developing online learning experiences, particularly if one starts making extensive use of resources that exist on

other web sites or that have been gathered through e-mail discussion groups.

CONCLUSION

This paper has drawn together a range of types of information in an effort to explore the potential and pitfalls of harnessing online learning to support education and training in South Africa. By way of conclusion, I would like to re-state the key threads that I hope run through this article:

- Effective use of any educational technology depends primarily on effective planning and design, which focuses on rigorous processes of analysing how to integrate these technologies into teaching and learning environments.
- There is substantial experience of the use of different technologies in South African education and training that can be tapped to avoid repetition of costly mistakes.
- Online learning offers no magical panacea to complicated educational problems.
- Substantial investment in thorough course design and development processes is a prerequisite for effective use of Internet technologies.

I hope that this makes a small contribution to building successful practice in harnessing the significant potential of online learning for education and training.