USE OF TECHNOLOGY TO IMPROVE TEACHING AND LEARNING IN UNIVERSITIES

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Abstract

The rationale for the use of technology, in the pursuit of excellence in teaching and learning in higher education can by no means be argued on strictly empirical grounds. The relatively recent emergency of many of the technologies has meant that there has been insufficient time for adequate empirical investigation .in one sense, technology may improve learning since it appears that much technology has the power to increase access to higher education. Technology such as audio-cassettes, video-cassette, printed study guide and computer based education is characterized by its ability to capture the essency of instructional process in a relatively permanent way, so that the delivery of instruction is not constraint by time and place. In this paper merits, demerits and the criteria for selecting media appropriate to their own institution would be discussed. Similarly, larger institution framework for developing materials would be outlined and the smallest institution systematic instructional design and development process would also be discussed in a more open ended way.

Key words: Technology, Teaching, Learning Universities.

Introduction

This is an information age, and is characterized by an infinite, dynamic and changing mass of information. Information is now exchanged very rapidly and knowledge is growing at an exponential rate. There is no possibility of individual scientists possessing all the knowledge within their discipline. Scientists, now and in the future, need to master the basic knowledge of their field and the skills necessary to navigate around their discipline. This shift is also true for teachers, who have traditionally been accepted as the sources of all knowledge and experience within the educational process. The teacher now is

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better represented as a key to open the door to domains of knowledge and experience.

As we enter a new era of technological possibilities, education will use technology in all its forms i.e. audio cassettes, video cassettes, printed study guides and computer based education so that the delivery of instruction is not constrained by time and place. In our universities, we use more technology resources than before. Electronic forms of communication are already used intensively in academic contexts. The use of multimedia, local networks, shared communication systems, the Internet, shared electronic databases, video conferencing facilities, electronic self-study materials, study support and guidance through networks, progress assessment systems, intake and monitoring systems, and so on, and this will enhance the development of new teaching and learning strategies.

Traditional Instruction and the Testing Culture

The traditional instructional approach viewed learners as passive recipients of information. Memorization of the content, narrated by the teacher, was the main goal of the instructional process. The deposited knowledge was merely abstracted.

Learning and teaching were individual processes with the individual teacher in front of the audience, a collection of individual students. The assessment approach that accompanied this teaching approach concentrated mainly on the testing of basic knowledge, supposedly, acquired through drill and practice experiences, rehearsals and repetitions of what was taught in class or in the textbook. During the past three decades, the development of tests for accountability purposes, as well as their scoring and interpretation, was dominated by measurement experts using sophisticated psychometric models. In the Western world, especially in the United States, their work was guided by

the demand for objectivity and fairness, requiring a high level of standardization because of the high stakes attributed to test scores. Under such circumstances, tests, mainly of the choice-response format, such as multiple-choice, true/false or matching items, were the common tools for assessment This assessment system is sometimes referred to as a 'testing culture' . It has the following characteristics:

(i) Instruction and assessment are considered as separate activities, the former being the responsibility of the teacher and the latter the responsibility of the measurement expert;

(ii) The test plan, the writing of each test item, the development of criteria for evaluating test performance and the scoring process are not usually shared with the students and remain a mystery to them;

(iii) The items/tasks are often synthetic, in as much as they are unrelated to the student's life experience;

(iv) The majority of test items are of the choice format, examining knowledge of decontextualized, discrete units of the subject matter;

(v) The tests are usually of the paper-and-pencil type, administered in class under time constraints and forbidding the use of helping materials and tools.

In other words, the first draft of the student's work produced under stressful conditions and within unrealistic constraints is often used for determining high-stake consequences. Also, what is being evaluated is merely the product, with no regard to the process, and the results usually take the form of a single total score.

These instruments have received a lot of criticism, traditional tests do not resemble actual learning tasks; also, tests don't seem to tap the actual conduct of problem solving. High on

the list of conventional testing practices is the focus on the easily quantifiable rather than messy and complex displays of skills and knowledge. Another criticism concerns the influence of testing practices on the instructional process. Traditional tests tend to narrow the learning process to consumption of knowledge provided by the teacher (i.e. the traditional instructional approach).

For many years, the main goal of academic education has been to make students knowledgeable within a certain domain. Building a basic knowledge store was the core issue. Recent developments in society have changed these goals. Emphasis is now on producing highly knowledgeable individuals as well as individuals with problem-solving and professional skills. The main goal of higher education has moved towards supporting students to develop into 'reflective practitioners' who are able to reflect critically upon their own professional practice. Students taking up positions in modern organizations need to be able to analyse information, to improve their problem-solving skills and communication and to reflect on their own role in the learning process. Increasingly people have to be able to acquire knowledge independently and to use this body of organized knowledge to solve unforeseen problems. In line with these changing goals in academic education and as opposed to the traditional approach, the current teaching and assessment conception stresses the importance of the acquisition of specific cognitive, meta-cognitive and social competencies.

To reach these goals, Koschmann (2001) *et al* describe six principles for effective learning and teaching.

- **The principle of multiplicity**: learning is the acquisition of knowledge that is in nature complex, dynamic, contextual and consisting of a network of interrelated elements.

- **The principle of activeness**: learning is an active and constructive process.
- **The principle of accommodation and adaptation**: learning is a process of acquiring information and transforming it into knowledge by linking it to and inserting it into the existing knowledge networks.
- **The principle of authenticity**: learning is determined by the learners'individual goals and the context in which the learning takes place.
- **The principle of articulation:** learning is enhanced by the formulation and abstraction of acquired knowledge.
- **The principle of termlessness**: learning is the acquisition of knowledge in evolution, in continuous change. Technology and new insights in learning and assessment.

What role can Technology play in the recent developments, such as the design of a powerful learning environment with an assessment culture? Gilbert (2000) refers to the term 'connected education': the use of Technology to connect students and teachers better to information, ideas and each other.

Van Tartwijk (1999) distinguishes between three categories of learning activity in which Technology can play a supporting role:

(i) communicating; e-mail, discussion lists, computer conferencing;

(ii) working on learning tasks; programmes for online testing, groupware, websites of online courses;

(iii) acquiring information; electronic databases, databases on the Internet, digital learning materials.

For assessment, Technology offers a set of possibilities, enhancing the implementation of an assessment culture. It enhances the implementation of the following principles.

(i) **Flexibility**: Which means no time, place or task restrictions. Students can take part in formative as well as summative assessment

(ii) **Assessment as a tool for learning**: The students have online, i.e. continuous, possibilities to diagnose their competencies .Additionally, most test-serving systems offer profound feedback. Students' progress is also available online. In this way, the integration of assessment within learning is enhanced.

(iii) **Responsibility of students for their learning**: Flexibility is one condition for giving more responsibility to the learner. A second condition is sharing responsibility in the process of assessment. The use of electronic peer assessment and electronic portfolios are examples of electronic assessment methods that are in line with this principle.

(iv) **Product and process assessment**: In most electronic portfolios as well as electronic peer-assessment systems, product and process criteria are used.

(v) **A variety of assessment instruments**: Technology enhances the permanent availability of a set of different assessment instruments, from measuring knowledge reproduction by standardized tests to the assessment of skills by electronic portfolios or peer-assessment systems.

(vi) **Authenticity of assessment**: Real-life cases, electronic simulation games etc. are available online, which makes it feasible to assess different aspects of students' competencies in an authentic way.

(vii) The student as an active participant in the assessment process.

One aspect is the students' responsibility to develop in the criteria for assessment through interaction and discussion with teachers.

Electronic peer assessment is one example. A second aspect is the use of assessment tasks that ask students to actively construct a solution to the task.

Examples are electronic, often online, simulations and electronic case-based assessment instruments.

As is clear from these seven principles, Technology can support the different functions of assessment.

First, it enhances the feedback function of assessment for teachers as well as for students.

Second, it makes summative assessment on the basis of students' individual goals and competencies (adaptive testing) more feasible. Technology within assessment can itself serve different functions. It can be used as a tool to enhance the efficiency of assessment practices. Examples are the use of spreadsheet programs, statistical packages, test-serving systems, e-mail to communicate about assessment (e.g. procedures, test results) etc. Technology can also make accessible tasks that are the basis of assessment, and other information that is necessary to fulfil the assessment tasks. Examples are simulations, real-life cases and electronic databases (see the Overall Test, below). The next section describes a set of assessment forms that use the seven principles and the functions described above.

Recent developments in the use of technology within assessment practices are in line with this statement. During the last decade, the use of a set of so-called new assessment forms has increased dramatically. Examples are authentic performance tasks, simulations, reflective journals, group projects, interviews, self-, peer and co assessment, electronic presentations, two-stage

assessments, short reports, portfolios and assessment centres. Although some of these methods have earlier been used as instructional methods, it is only recently that they have been used as tools for assessment. Below we will present recent assessment forms and describe the function of technology. We will elaborate on three assessment forms: self-, peer and co-assessment, the Over All Test and portfolios.

Self, Peer and Co-assessment

Peer assessment is a process whereby groups of students assess their peers on the basis of mutually agreed criteria.

Self-assessment refers to the assessment of students' competency by themselves.

Co-assessment indicates that the assessment is a shared responsibility between the teacher and the students.

Self-, peer and co-assessment are used for assessing products of learning such as reports, presentations, reflective journals, designs etc. These assessment forms are also used on the process level. Assessment of a team working on a product, working in a project team or discussing in a tutorial group within a problem-based learning environment are examples of process assessment. Finally, peer assessment is often used to correct a group score for a product on the basis of an individual contribution.

Necessary Conditions

The Selection of Instructional Technologies at the institutional level is the critical first step. It may be helpful for decision makers to consider the following criteria for selecting media appropriate to their institution:

1. Availability. It is important that the technology selected should be well established in the local environment. So that

sufficient trained manpower is available to facilitate the continued reliable use of the medium.

2. Accessibility, Ideally the chosen technology must be universally available to all srudents
3. Acceptability The attitude of both academic staff and students must be favourably disposed towards the use of the technology.

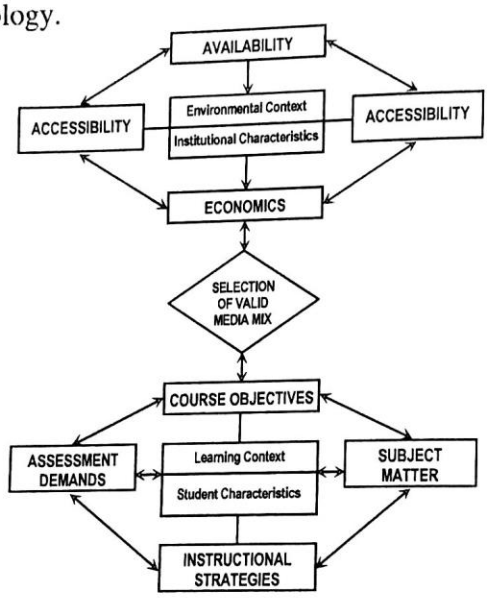

Figure: Criteria for the selection of a valid media mix at the level of a course of study

This figure gives an overview equally well applicable to all types of higher education institutions in various states of development, whether long established, recently established or even yet to be established

Results and Discussion

Developments in the learning environment and in the assessment culture stress the change in the main goal of learning from 'knowing a lot' to 'being able to use knowledge and skills to tackle problems. The emergence of so-called competency-based education and the so-called powerful learning

environments are examples of this shift in thinking. In order to reach this goal, the explicit objective for the design of the powerful learning environment is to interweave assessment and instruction. New assessment forms such as self-, peer and co assessment and portfolios are implemented increasingly in universities. Although the results of research on the implementation of the 'new assessment culture' are promising, the use of new assessment procedures as a tool for learning has not been entirely positive. Madaus and Kellaghan (1993) refer to problems with the organization, time and costs of authentic assessment programmes. Birenbaum (1996) advocates that different assessment instruments serve different purposes and therefore we should introduce balanced or pluralistic assessment programmes.

Additionally, Messick (1984) indicates that each assessment form has its own method variance, which interacts with persons (the assessors and the students assessed).

Lehtinen *et al.* (1998) have reviewed the research on the effects of technology. They concluded that, because of weak research designs and the absence of clear empirical data, up until now only few research projects have been able to answer the question of the added value of computers and networks in technology environments in comparison with co-operative learning environments without technology. There is even less evidence about the effect of the Technology within assessment practices. There is clear growth in the use of Technology in assessment for different purposes, such as administrative support (test-service systems), a tool to support communication between teachers and students, a tool for feedback, and flexible and easy access to databases and other sources of information. Whether Technology can fulfill these purposes and enhance the

integration of learning and assessment, and in what sense and under which conditions, is on the agenda for future research.

Research has been done on the way Technology is used in higher education (1999).

The results indicate that recent Technology applications stress the active participation of students and co-operation between students. Websites are used to search for and study information as well as to exchange information. Webboard and Webconference are examples of applications used increasingly in education. It is concluded by Collis and van der Wende (1999) that the effectiveness, efficiency and flexibility of learning is enhanced by the use of Technology. This conclusion is based on indications such as students' increased satisfaction with education. One of their final remarks implies a challenge for future developments and research. It is stated that up until now there is no empirical evidence that developments in Technology have produced students that are more competent. This remark raises new questions. In summarizing, the challenges facing us in the near future, we propose three main themes.

First, although there is an increasing amount of research and literature, there are still many questions about the quality of the new assessment instrument. Various authors have recently proposed ways to extend the quality criteria, techniques and methods used in traditional psychometrics (2000).

Second, in only a few cases is there systematic implementation of applications. Mostly, Technology is used individually or for certain projects. Different kinds of application are often used for different purposes within one department without a shared view on learning, instruction and Technology. The use of Technology in powerful learning environments is in most cases still a matter of pioneering. Systematic

implementation of Technology in these learning environments is an important condition for starting empirical research projects.

Third, pressure that Technology puts on time and task loads for teachers as well as staff members is in most cases perceived to be high . Green (1999), states that "for many institutions user support and instructional integration are the flip side of the same coin, complementary components of the broad challenge that involves the effective use of new technologies in teaching, learning, and scholarship". Training of staff members in the integration of Technology in the learning environment will be high on the agenda of most universities.

Fourth, the research methods and frameworks for investigating the effects of Technology on learning are still in development (2001).

Recommendation

- Determine the purpose, goal of using technology in the classroom, as determined by the specified educational goals. Is it used to support inquiry, enhance communication, extend access to resources, guide students to analyze and visualize data, enable product development, or encourage expression of ideas? After the purpose is determined, select the appropriate technology and develop the curricula. Create a plan for evaluating students' work and assessing the impact of the technology.

  All students should have equitable access and use of technology—females, special-needs students, minority students, disadvantaged students, students at risk of educational failure, rural and inner-city students. All students need opportunities to use technology in meaningful, authentic tasks that develop higher-order thinking skills

- to provide professional development to teachers to help them choose the most appropriate technologies and instructional strategies to meet these goals
- Coordinate technology implementation efforts with core learning goals, such as improving students' writing skills, reading comprehension, mathematical reasoning, and problem-solving skills.
- Collaborate with colleagues to design curricula that involve students in meaningful learning activities in which technology is used for research, data analysis, synthesis, and communication.
- Promote the use of learning circles, which offer opportunities for students to exchange ideas with other students, teachers, and professionals across the world.
- Encourage students to broaden their horizons with technology by means of global connections, electronic visualization, electronic field trips, and online research and publishing.
- Ensure that students have equitable access to various technologies (such as presentation software, video production, Web page production, word processing, modeling software, and desktop publishing software) to produce projects that demonstrate what they have learned in particular areas of the curriculum.
- Encourage students to collaborate on projects and to use peer assessment to critique each other's work.
- In addition to standardized tests, use alternative assessment strategies that are based on students' performance of authentic tasks. One strategy is to help students develop electronic portfolios of their work to be used for assessment purposes.

- Ensure that technology-rich student products can be evaluated directly in relation to the goals for student outcomes, rather than according to students' level of skill with the technology.
- Create opportunities for students to share their work publicly--through performances, public service, open houses, science fairs, and videos. Use these occasions to inform parents and community members of the kinds of learning outcomes the school is providing for students.
- Learn how various technologies are used today in the world of work, and help students see the value of technology applications.
- Participate in professional development activities to gain experience with various types of educational technology and learn how to integrate this technology into the curriculum.
- Use technology (such as an e-mail list) to connect with other teachers outside the school or district and compare successful strategies for teaching with technology.

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