

Approach for Integrating ICT in Teaching-Learning Process

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Abstract: With the rapid pace of technological and scientific developments, the educational technology has also transformed quite significantly. The teaching-learning process has been upgraded with the aid of computers in many ways from traditional method to modern system. Substantiating these trends, today's teaching-learning is being conducted through e-learning, mobile-learning, web-based learning, multi-media learning, etc. All these technological advancements in imparting learning would bring interest, curiosity and enhance imagination, problem solving ability and aggressive thinking capacity which will augur well for research and development for younger generation. As Internet is becoming the worldwide classroom, the accessibility to information becomes reality at any point of time. Learning of professional courses requires such modern type of tools to make the learning very meaningful.

This paper emphasizes that the potential of new technologies to support innovation towards more student-centred approaches in the learning environment will only be realised if the use of new technologies is prescribed within the context of the whole curriculum. Against this background an approach for planning for technology use in the teaching and learning environment is presented.

I. INTRODUCTION

Modernization of education has become an essential aspect of knowledge base in each and every domain of various faculties of education. The rapid pace with which world is changing is phenomenal which warrant a dynamic way of teaching and learning. These developments in education demand a value based, purpose and technology based learning which can be promoted by using of multimedia tools that makes the learning flexible, need based and objective oriented. As the education process is becoming globally competitive, competent talent has to be developed among the learners to grasp the required knowledge in a specific domain. Information and Communication Technology (ICT) based learning environment includes course materials that are available online.

It is argued in this paper that new technologies be considered part of a toolset which can be used in formulating a pedagogical solution to the key problem of increasing the effectiveness of the teaching-learning environment. A planning approach that places primary focus on the teaching process rather than on technology and thus supports the appropriate use of new technologies in the learning environment is proposed. The planning approach is based on student-centred philosophy and the notion of reflective practice. The approach presented thus focuses attention to some issues for the development of professional development

initiatives aimed at increasing effective technology use in educational settings.

II. INFORMATION AND COMMUNICATION TECHNOLOGY IN EDUCATION

With the advent of computers there is a phenomenal development in all the fields of education, research, inventions, innovations and also living styles of human life and their social status. The world is witnessing many innovations and inventions, which are modernizing the human race in many ways. All these have become a possibility due to the facilitation offered by ICT. Supplementing these developments are the learning methodologies, which emerged with the evolution of computers. Such learning methodologies being e-learning, web-based learning, multimedia learning, etc. Internet provision provides every one easy access to the necessitated information without any hassle and difficulty. In the present day context, such emerging learning techniques have become the order of the day and this provision also develops creativity and imagination in the minds of learners. At the same time teachers also facilitate the learners to become more active in their learning process.

Both computer and web based multimedia materials encompasses content that are itself dynamic in nature. But the content of technology based learning environment has the potential to engage all the stakeholders in the education system – starting from software developers to educational researchers to teachers and students. Technologies can be broken into two basic categories; asynchronous, in which communication does not occur in "real-time" and synchronous, where work is done over networks in "real-time". Asynchronous technologies include traditional correspondence courses, e-mail, database and message boards. There are advantages to asynchronous learning, especially when hypermedia is used. Learners are able to review in depth the materials, compose critical responses and attend to the learning with a level of comfort and confidence. Synchronous technologies include various "chat" applications, streaming audio and streaming video. These media allow for more collaborative work, brainstorming and more constructive learning.

A. Types of Technology based Learning Environment

1. M-learning

'M-learning' is the follow up of E-learning which for its part originates from D-learning (distance education). M-learning is the delivery of learning to students who are not keeping a fixed location or through the use of mobile or portable technology. The rapid growth of ICT makes it possible to develop new forms of this education. M-learning is the term given to the delivery of training by means of mobile devices such as mobile phones, PDA's (Personal Digital

Assistants) and digital audio players, as well as digital cameras and voice recorders, pen scanners etc.

2. E-Learning

E-learning is an approach to learning and development: a collection of tools and techniques utilizing digital technologies, which enable, distribute and enhance learning. If e-learning took learning away from the classroom or campus, then m-learning is taking learning away from a fixed point. While e-learning is an alternative to classroom learning (actually e-Learning should/can be complementary to classroom learning), m-learning is a complementary activity to both e-learning and traditional learning. In one sense m-learning has been around for longer than e-learning, with the paperback book and other portable resources, but technology is what shapes today's usage of m-learning.

3. Teleconferencing – Audio, Video, Computer and Desktop

There are different types of teleconferencing (for example audio, video, and computer conferencing including desktop videoconferencing), but they all provide some form of two-way interaction. Regardless of the exact nature of the teleconference, a good moderator is required to keep the discussion focused and on schedule. A particularly effective teleconference technique is to have a local activity at each site that prepares participants for, or follows up on, the broadcast event. A common way is to organize a local panel of experts to discuss the same issues covered by the main presenters, but in the local context.

This allows for greater participation at each site. The most common form of teleconferencing is satellite teleconferences which involve one-way television broadcasts and two-way audio links. Digital videoconferencing provides even more interactive capability because it involves two-way audio and video transmission between each site. In a well-organized audio-conference, an agenda, the list of participants and any other required materials will be delivered to everyone well in advance.

4. Interactive Multimedia – Expanding Computer-Based Training

Interactive multimedia implies two important capabilities:

1. To be able to present information in multiple modalities and
2. To allow the user to control the interaction to varying degrees depending on the nature of the program.

These have to be done to the extent that almost all forms of learning are enhanced by involving multiple modalities and by having interactions.

Benefits of multimedia for learning include: increased motivation, appeal to different learning styles, more realism, facilitation of multilingual presentations, higher retention, better comprehension and improved transfer of skills. Multimedia technology makes it easy to create and capture information in different forms as well as present it. If designed properly, multimedia programs can be motivating and realistic; but this is not an inherent characteristic of the technology. Another on going challenge is the constant emergence of new multimedia capabilities. Even before a program is completed and fielded, it is likely that some of the multimedia features will be enhanced in newer versions of software and hardware. Because such a wide range of skills/knowledge is needed to

develop multimedia programs, a team approach is recommended.

5. Web-Based Training (WBT)

The WBT uses web-based technologies for the purpose of training. WBT can be used to deliver complex training, such as a sales training course for a worldwide sales team. The main attributes of WBT are listed below:

- i. Several WBTs offer mentoring and coaching services, which allow learners to interact with the instructor over e-mail, chat forums, or videoconference.
- ii. Several WBTs offer learners the opportunity to interact and collaborate with peers in discussions in chat groups, collaborate on projects, or participate in online seminars.
- iii. Learners in remote locations can use the courses any time.
- iv. Multiple media such as text, graphics, video and animations are used to communicate the content.
- v. Questions, quizzes, simulations and feedback provide interaction with the student.

III. PEDAGOGY DESIGN

Research has shown that the appropriate use of ICTs can catalyze a paradigm shift in both content and pedagogy that is at the heart of education reform in the 21st century. If designed and implemented properly, ICT-supported education can promote the acquisition of the knowledge and skills that will empower students for lifelong learning.

When used appropriately, ICTs—especially computers and Internet technologies—enable new ways of teaching and learning rather than simply allow teachers and students to do what they have done before in a better way. These new ways of teaching and learning are underpinned by constructivist theories of learning and constitute a shift from a teacher-centered pedagogy—in its worst form characterized by memorization and rote learning—to one that is learner-centered. (See Table 1 for a comparison of a traditional pedagogy and an emerging pedagogy enabled by ICTs.)

As learning shifts from the “teacher-centered model” to a “learner-centered model”, the teacher becomes less the sole voice of authority and more the facilitator, mentor and coach—from “sage on stage” to “guide on the side”. The teacher’s primary task becomes to teach the students how to ask questions and pose problems, formulate hypotheses, locate information and then critically assess the information found in relation to the problems posed. And since ICT-enhanced learning is a new experience even for the teachers, the teachers become co-learners and discover new things along with their students.

• **Active learning.** ICT-enhanced learning mobilizes tools for examination, calculation and analysis of information, thus providing a platform for student inquiry, analysis and construction of new information. Learners therefore learn as they do and, whenever appropriate, work on real-life problems in-depth, making learning less abstract and more relevant to the learner’s life situation. In this way, and in contrast to memorization-based or rote learning, ICT-enhanced learning promotes increased learner engagement. ICT-enhanced learning is also “just-in-time” learning in which learners can choose what to learn when they need to learn it.

• **Collaborative learning.** ICT-supported learning encourages interaction and cooperation among students, teachers, and

experts regardless of where they are. Apart from modeling real-world interactions, ICT-supported learning provides learners the opportunity to work with people from different cultures, thereby helping to enhance learners' teaming and communicative skills as well as their global awareness. It models learning done throughout the learner's lifetime by expanding the learning space to include not just peers but also mentors and experts from different fields.

Table 1. Comparison of Traditional Pedagogy and an Emerging Pedagogy enabled by ICTs

Aspect	Less ('Traditional pedagogy')	More ('Emerging pedagogy' for the information society)
Active	<ul style="list-style-type: none"> ▪ Activities prescribed by teacher ▪ Whole class instruction ▪ Little variation in activities ▪ Pace determined by the programme 	<ul style="list-style-type: none"> ▪ Activities determined by learners ▪ Small groups ▪ Many different activities ▪ Pace determined by learners
Collaborative	<ul style="list-style-type: none"> ▪ Individual ▪ Homogenous groups ▪ Everyone for him/herself 	<ul style="list-style-type: none"> ▪ Working in teams ▪ Heterogeneous groups ▪ Supporting each other
Creative	<ul style="list-style-type: none"> ▪ Reproductive learning ▪ Apply known solutions to problems 	<ul style="list-style-type: none"> ▪ Productive learning ▪ Find new solutions to problems
Integrative	<ul style="list-style-type: none"> ▪ No link between theory and practice ▪ Separate subjects ▪ Discipline-based ▪ Individual teachers 	<ul style="list-style-type: none"> ▪ Integrating theory and practice ▪ Relations between subjects ▪ Thematic ▪ Teams of teachers
Evaluative	<ul style="list-style-type: none"> ▪ Teacher-directed ▪ Summative 	<ul style="list-style-type: none"> ▪ Student-directed ▪ Diagnostic

• **Creative Learning.** ICT-supported learning promotes the manipulation of existing information and the creation of real-world products rather than the regurgitation of received information.

• **Integrative learning.** ICT-enhanced learning promotes a thematic, integrative approach to teaching and learning. This approach eliminates the artificial separation between the different disciplines and between theory and practice that characterizes the traditional classroom approach.

• **Evaluative learning.** ICT-enhanced learning is student-directed and diagnostic. Unlike static, text- or print-based educational technologies, ICT-enhanced learning recognizes that there are many different learning pathways and many different articulations of knowledge. ICTs allow learners to explore and discover rather than merely listen and remember.

IV. INTEGRATION OF TECHNOLOGY AS AN EVOLUTIONARY PROCESS

The effective integration of technologies into educational contexts may be considered as a process of transformation rather than a simple translation of traditional approaches to another medium (Torrise & Davis, 2000). Sandholtz, Ringstaff and Dwyer (1997) present a framework that suggests a full integration of technology accompanied by significant changes in teaching practice as the third and final stage (transformation) of a continuum of adoption of technology in the learning environment. This third stage of transformation is preceded by first stage of entry (awareness of possibilities) and the second of adaptation (low-level integration). A suggested approach for the appropriate integration of technology into teaching learning environments is represented in Figure 1.

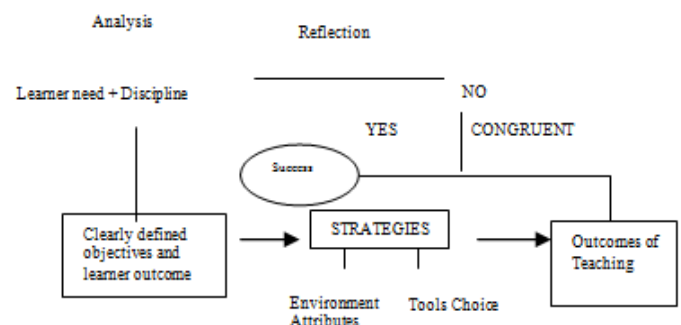


Figure 1 Suggested approach for the appropriate integration of technology into the teaching-learning environment

The major goal of the described approach is to support the integration of new technologies with other instructional tools and strategies in the curriculum in ways that support a student centered approach and in so doing allowing technology use to be an integral part of "knowledge spaces" which "allow users to explore as they wish" (Brown, 1997)

Consistent with learner-centered approaches the process begins with an analysis of learner characteristics and of learner needs in relation to the content that is to be 'taught'. In defining the learner needs, the demands of the content must also be taken into account. "The content of student learning (what is taught) logically precedes the method of teaching content...without content there is no teaching method". On the basis of this analysis of the learner and the content, clearly defined objectives and corresponding outcomes are formulated.

The integration of the technology in the learning space now becomes a problem solving exercise for the educator with the key question being: 'In the light of learner needs and content requirements, how are each of these intended outcomes best achieved?' In solving the problem, the educator must not neglect to take into account environmental attributes (e.g. location, available equipment, funding etc), which will constrain available strategy implementation options.

In formulating a teaching strategy to solve the problem, 'tools' to help implement the strategy must be chosen. Here then is the crux of the matter of integrating new technologies. New technologies such as multimedia and online technologies are considered 'tools' along with face to face contact, print and other options. Appropriate tool choices depend on an awareness of the attributes of each tool and then matching the requirements of the chosen strategy with the

available 'tools' that best serve those requirements. Table 2 shows the choices for teaching and learning and their main advantages and disadvantages.

Table 2: Some common tool choices for teaching and learning and their main advantages and disadvantages

Tool	Advantages	Disadvantages
1. Textbook & other print materials	Portable, inexpensive, simple 'low-tech', easy to use, pre-organised quantities of information, accessible without special equipment, can be inexpensive, most educators familiar with this medium and have production expertise.	Become outdated, cannot update easily, static information presentation, no interaction possibilities
2. Video	Motivational, sound and images to convey information, readily available, easy to use, inexpensive.	Linear information presentation, multiple copies for student access at home can be problematic / expensive; Video production can be expensive and time consuming, requires VCR access and display mechanism.
3. Face to Face teaching	Can respond to needs of students dynamically, can be used to promote discussion, collaborative learning, enables clarification and analysis of information.	No flexibility for students in terms of attendance Access limited to on campus.
4. Multimedia CD ROM	Can convey information using video, audio, sound and text; Once produced, inexpensive to replicate for student access; Option for non-linear information presentation, so learners are able to explore at their own pace, forming their own pathways; High interactive learning potential.	Costly both in terms of time and money to produce; Production requires a high level of technical expertise; Software and content become outdated – cannot update easily without undergoing another development and production run.
5. World wide web –	Increasingly supporting	Requires costly technical

Tool	Advantages	Disadvantages
websites & related internet technologies	multimodal presentation - text, images, sound, video and higher levels of interactive possibilities; Access to up to date information; Potential for collaborative learning with learners in multiple location (e.g. chat, video conferencing); Potential for 'anytime', 'anyplace'; Highly motivational; Updating of information relatively easy.	infrastructure (networks, workstations, video conferencing facilities). As technology capabilities increase so does complexity, and level of commitment required and the potential of 'things not working'. Development of own online materials: - complex requiring expertise in areas such as coding, video digitisation; Can be costly and very time-consuming; Demands a high level of commitment; Updating web materials can be difficult/frustrating if not technically competent to some degree; Sophistication of web materials available to students is limited by access factors such as bandwidth, modem capabilities. Not all educators are familiar / comfortable with the new media technologies – steep learning curve both in technical understanding and implementation strategies; Lack of awareness of these issues is one of the greatest pitfalls in adopting new technologies.
	Wealth of up to date information available along with non-linear nature, interactivity and multimodal presentation can support discovery orientated strategies.	

The strength of the integrated approach is twofold. Firstly, the focus is on the needs of the learner and the learning situation, not the technology *per se*. If technology is implemented it is done so on the basis of a learner-centered 'needs analysis' of the whole learning situation. In this way, the manner in which technology is implemented is inextricably linked with the learner needs and the subject requirements and

objectives. This approach does not exclude the use of more traditional approaches or tools such as print etc if they are deemed appropriate to the learning situation. Secondly, the proposed approach does not necessarily demand the invention of new strategies to accommodate technology. The strategy that is finally implemented may have been used previously; it may be an improvement on an existing strategy or an entirely new strategy. Evidently, the process must not culminate with the implementation of the strategy. The final step is the most critical for the development of a dynamic learning environment that meets the changing needs of learner and society. Execution of the strategy must be followed by a careful analysis of congruency of intended and actual outcomes. Main design decisions which highlights the integration of the various elements is given in Figure 2.

Figure 2.0 Summary of the main design decisions, highlighting the integration of the various elements.

Environment and Student Characteristics	Tools Selected	Learner Outcomes Required
Good Technical Infrastructure Access needed available away from campus Minimize content delivery in face-face contact time Students not engaging with content Portable resource needed during practicals	Web Site Face-Face Print Materials	Challenge their own assumption Analyze thinking underlying practice Connect theoretical experience with their own experience Think through how values can be incorporated into real situation

CONCLUSION

Inappropriate use of technologies in the teaching and learning environment can be minimised through the approach suggested which does not focus primarily on technology but instead directs focus on learner needs, discipline requirements, learning outcomes and reflection on teaching practices. Technology implemented as an integral component of teaching and learning strategies formulated to meet learner and discipline needs is most likely to efficiently fulfill desired learning outcomes.

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