
e-Learning: Prospects and Challenges



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Abstract

The past two decades have seen phenomenal developments in the application of media and technology in education. With the amazing Internet connecting personal computers and mobile devices distributed around the world, the field of education has tried to exploit the web as a communications channel to connect distant learners with instructors and a rapidly growing plethora of learning material. Today, even primary school children easily conduct research from their homes and create media rich submissions for their assignments. Technologies, tools, techniques, methodologies and standards are advancing at such a rapid pace so as to overwhelm the ability of educationists to isolate, study, and report on the best methods to be used for any given audience. With all these advances, the prospects for E-Learning are clearly bright and many. But the real challenge facing many of us is to ensure that we develop appropriate theoretical frameworks and formal approaches, which guarantee that we do not stop merely at creating technical solutions, but press on to document the impact of technology on learning, and pass along lessons learned. Further, in a developing country like India, the digital divide is still with us, and appropriate use of technology requires consideration of a wide range of low-tech and high-tech solutions. Our responsibility as educators is to humans and not to machines. Empirical evaluations of education technology solutions are essential before attempting wide dissemination. This keynote will primarily address some of the above issues and also present brief details of some of speaker's research work addressing these issues.

1. E-Learning Environments and Prospects

E-Learning, specifically, is becoming a prominent learning environment aimed at providing student-centric, self-paced

instruction using the electronic medium of the World Wide Web (www).

E-Learning has evolved and acquired a certain maturity level as can be seen through the increasing deployment of various tools and standards listed:

- a. Available tools in the form of Learning Management Systems like WebCT , Blackboard etc., Authoring tools like Macromedia, etc,
- b. Standards for content reuse, discovery and packaging like SCORM, IEEE LOM 1484.12.1 etc., and
- c. Deployment of these standards in the form of reusable Learning Objects.

Any E-Learning environment can be perceived through a layered model with a body of knowledge to be learned as the topmost layer and the learner at the bottom. Figure 1 shows a diagrammatic representation of the model. It is common belief that each of the layers needs to be appropriately designed and/or integrated in order to make a successful E-learning learning environment.

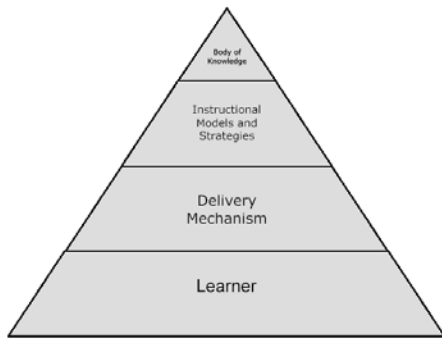


Figure 1 A Layered model for E-learning environments

1.1 Body of Knowledge

This layer is concerned with representation schemes for the body of knowledge. One major issue that needs to be considered is whether the representation be such as to permit non-linear access or a strict linear access. A common technique used is that of a hypermedia e-book [Gerhard Weber et al 1997] or of a concept graph [Nicola Capuano et al 2000, M. Spacht et al 1998].

1.2 Instruction Design Models and Instructional Strategies

A model is a mental picture that helps us understand something we cannot see or experience directly [Dorin et al 1990]. It is apparent that while technology offers a wide range of learning facilities, it presents a new set of challenges. One primary concern is about instruction design for learning a body of knowledge in E-learning environments.

It may be interesting to view the term 'instruction' as provided in [Romiszowaski 1984] – “not all the education or training is necessarily instruction, but instruction is a necessary and important part of education and training systems. Instruction thus is a goal directed teaching process, which has been pre-planned and tested”. Please refer to Table 1.

		Specific objectives exist?	
		Yes	No
Pre-planned study resource exists	Yes	Instruction	Visit to theatre / museum, study tours, library ,Net surfing*
	No	Project , apprenticeships, research, etc.	Incidental learning

Table 1 A definition of Instruction [Romiszowaski 1984-1]

While designing and developing instruction for an E-learning environment many issues need to be investigated. These include:

- What is the best way to design instructional content for E-learning?
- Should a formal model be used?
- What kind of support should ideally be provided to a person designing instructional content?
- How can we evaluate the effectiveness of the instruction from the student's as well as the instructor's perspective?

We strongly believe that for answering the above issues, empirical investigations are essential for evaluating many of the proposed solutions to problems that exist in an E-learning environment. Instructional design includes the entire process from the analysis of learner needs and learner goals to the development of a delivery system to meet those needs and goals.

Instructional strategies deal with the style of presentation of instructional content. Several

approaches are in use. For example, in expository presentation, a lecture or presentation or a telling strategy is used during instruction. The teacher/learning environment is in control of presenting the subject matter and s/he/it directs the learner through the lesson. The other is inquisitory presentation, which is based on questioning strategies to engage learners in discovering rules and relationships. Either one or a combination of strategies may be adapted while presenting the instruction.

1.3 Instruction Delivery

For content delivery in E-learning, the following models are prevalent today.

A. Synchronous: Synchronous model is a real-time, instructor-led online learning event in which all participants are logged into the E-learning environment at the same time and they communicate directly with each other.

B. Asynchronous: Self study learning experiences rely on some structured plan that directs the learner through learning **experiences without real-time interaction from an instructor.** CD-ROM based tutorials, paper-based correspondence and "Click-to-learn" web based systems are examples of this learning format

C. Hybrid: Some of the hybrid models in use are listed with brief descriptions below:

- An interactive, instructor-led, asynchronous e-course featuring one-on-one contact with an instructor via discussion threads and e-mail.
- An interactive, instructor-led, asynchronous e-course including student activities required to be completed within a given time frame.
- An interactive, instructor-led, asynchronous e-course as above but with synchronous components, such as a live virtual classroom for class, helps sessions, group or one-on-one presentations, office hours and chat.

1.4 Learner

This layer represents the learner by a model that abstracts learner's preferences, behaviour and achievements in a learning environment.

From the above, we can see that there are three major aspects of an E-Learning environment –

- Instruction Content Design which is the pedagogical aspect,
- Content creation, content management and learner management which is technological aspect and
- Evaluation of effectiveness of such an environment.

Although there is an ongoing effort to take care of technical challenges like achieving interactivity in web casts for synchronous E-Learning etc. what is required is a **formal methodology which allows systematic content design and then an empirical evaluation of effectiveness of E-Learning environment created in such a way.**

2. A Prototype Solution for Systematic Content Design

What is required is a framework that allows integration of both the pedagogical and the technological aspects. It has been shown that the learning environment that gets developed with active participation from subject matter experts proves to be most effective. However subject matter experts are not always good communicators or good designers. Thus, much like the software development process, what is required is a process model on which to base the content creation process. In our earlier work, we have prescribed one such model [Mudur et al 2002], which we briefly describe below.

Like in most other instruction design models, this model too proposes curricula goal to be broken up into attainable objectives and hence into semantically meaningful units of instruction – termed as **Concepts**. These can be structured as **concept graph**.

These goal-based concepts can be that they convey and level (of knowledge/learning), which the learner is expected to attain. The Integrative model proposes sixteen distinct classes based on Merrill’s classification [Mudur et al 2002]. These are termed as **Learning Unit Classes (LUCs); Please refer Figure 2.** To impart a correct learning experience several building blocks for learning or learning events have been identified – termed as **Learning Primitives; Please refer Figure 3.** Thus by assembling a knowledge concept, belonging to a particular LUC, as a set of required learning primitives, we can achieve the right level of **granularity** for concepts.

classified on the basis of the knowledge type Customizable templates for the different Learning Unit Classes help encapsulate best practices in instruction design and content development and sequencing of learning events. The process model thus guides the development of instructional material, making it simultaneously more formal and easy to develop high quality content. The issue now is the following: Does course content, developed using these models, lead to improved learning? Empirical evaluation is perhaps the only way one can hope to get reliable answers to such questions. In [Mudur et al 2005], we describe such empirical evaluations that have been carried out in a live educational environment.

















CONCEPT LEARNING LEVEL TYPE ▼	MEMORIZE	UNDERSTAND	APPLY	PROBLEM SOLVE
PART-OF /FACT OBJECTIVE ►	 LUC 11 Recall or state fact	 LUC 12 Recognize/Identify fact	 LUC13 Use/apply fact in carrying out task	 LUC 14 Identify required fact and use/apply in task
KIND-OF CLASSIFICATION OBJECTIVE ►	 LUC 21 Recall examples / non-examples	 LUC 22 Recognize example / non-example;	 LUC 23 Use correct example.	 LUC 24 Predict/identify variation in attributes of example in current context and use
PROCEDURE OBJECTIVE ►	 LUC 31 Recall rule / procedure	 LUC 32 Select / identify the appropriate procedure	 LUC 33 Use/apply a procedure/skill	 LUC 34 Trouble shoot, adapt variant to solve problem
PRINCIPLE OBJECTIVE ►	 LUC 41 Recall principle	 LUC 42 Identify scenario in which principle is applicable	 LUC 43 Apply the principle in a known scenario	 LUC 44 Identify and Apply the principle in an unknown scenario

Figure 2 LUC based model with iconic notations

CASE STUDY	Learning	The case study is a teaching strategy which requires learners to draw upon their past experiences, is participatory and has action components which are links to future experience. An example case study that guides the learner during problem solving.
EVALUATION	Environment	Monitors learner's progress. This primitive will be able to access / update the learner model. << can be implemented as set of tasks like posting the results , mailing comments to individual learner etc.>>
WORKSPACE	Environment	Presents the learner with a space on the screen/memory of the learning system to interact with co-learner, facilitator, to her/his own work. << For example one entity in it can be implementing link to chat board>>
LIVE DISCUSSION and ADDRESS BOOK	Environment	Provides address, a limited access to group learning in the form of a group address book and a facility to discuss on line.

Figure 3 List of few learning primitives

In [Radhakrishnan et al, 2005], we describe the use of such a formal methodical approach for a completely different audience, transplant patients who need to be educated in a hospital set-up.

3. Conclusion

E-Learning environments are evolving rapidly in terms of tools, techniques and standards. There are major pedagogical, technological and evaluation issues that must be addressed in deploying the above technologies. With rapid growth of the Internet and mobile communications, the prospects for a country like India are vast in terms of socio-economic benefits. It is important to recognize that our primary concern must always be human learning. Low-cost technology and relevant educational content with appropriate deployment strategies are needed to address the digital divide situation that still persists. More formal approaches in the form of development and evaluation methodologies have to be evolved.

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