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E-LEARNING CHALLENGES AND OPPORTUNITIES IN EGYPT

Abstract

The purpose of this paper is to provide a model for a basic understanding of the different services that e-learning technology provide and tu see how they fit together into an overall e-learning application infrastructure. The paper provides a functional overview of the components and processes that make up an e-learning environment, and it highlights the need to cope with an increasing number of students willing and capable of pursuing their education without time or place constraints.

1. Introduction

With the increase in student enrolments, pressure in state universities' budgets and the potential of new technologies for education, e-learning is becoming ever more prevalent. It is believed that the learning and management systems that underlie e-learning initiatives are to become part of the core for all educational institutions.

E-learning refers to learning that is delivered or enabled via electronic technology. It encompasses learning delivered via a range of technologies, such as the internet, television, videotape, intelligent tutoring systems, and computer-based training.

Blended learning refers to the use of more than one learning medium, usually a combination of instructor-led learning with web-based tools. The effectiveness of a blended approach is not new in K-12 or higher education, however, i. e. where it has been the context in which most e-learning takes place.

Recent advances in the availability and speed of Internet access and in the power and availability of personal computing platforms have dramatically increased opportunities as regards collaborative environments and other distributed learning technologies and also for the development of very efficient software packages.

As e-learning implementations grow in size and complexity, demands put upon underlying technology become more rigorous. The technology infrastructure must have the capacity to support the users' and network load, it should be scalable to support growth, it must be stable to ensure a high level of availability for learners, it should provide an open environment to support interoperability between components, and it needs to provide security to protect distributed users and content.

The educational challenge today is to demonstrate that e-learning is superior to book-centric learning and that Internet-centric problem solving helps students avoid

the memorizing of unnecessary information. In fact, we teach our students by what is called just-in-case content mastery so that they are exposed to many things. Most of this they will never need and will forget within a short time after learning, which seems wasteful of a student's time, effort and money paid for tuition. They will just remember a few things that are frequently used, because this blunts the forgetting curve. Just-in-case education is wasteful of student and faculty time. It can be replaced with just-in-time information access. Google and the Internet have created a new opportunity to develop education within the framework of just-in-time information access. This new kind of learning is with computers and the Internet .

A real problem being faced in Egypt, i. e. where 65% of secondary school graduates can be accepted in to state university .This promts students and their parents to investigate all means via which they successfully complete and acquire high marks, so they will tend to seek a private teacher with experience of the examinations is usually assigned by assessors in the ministry of education (using classical patterns for examination). A student is taught to solve a problem without even having read of it. Such students face a lot of difficulties in the first year in the college of engineering, which accepts students gaining a more than 92% secondary school score. The success rate is around 30-40% in the first year in the college of engineering due to people's difficulties in understanding and reasoning. Most of the courses need a problem solver – not a memorizing media. Accepting this comparison, it is clear that the time is right to review our educational programs and form exploring a shift away from training our brains to memorize and recall to training our brains to think, analyze and solve.

We are moving away from comprehensive memorizing, from just-in-case we need it in the future to just-in-time access to knowledge. Google and the high speed Internet make this shift in educational paradigm possible.

2. Internet-assisted learning

Online learning, as a subset of all distance education, has always been concerned with providing access to educational experience that is at least more flexible in time and in space than campus-based education.

The growing ease with which content can be updated and revised is making online learning content much more responsive and potentially more current than content developed for other media.

The Web affords interaction in many modalities. In *Figure 1*, we see the common forms of media used in distance education charted against their capacity to support independence (of time and place) and their capacity to support interaction. It can be seen that, generally, the higher and richer the form of communication, the more restrictions it places on independence.

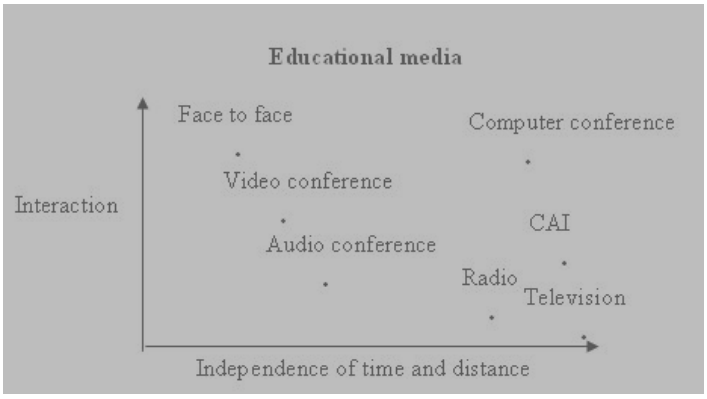

Figure 1: Different Educational Media

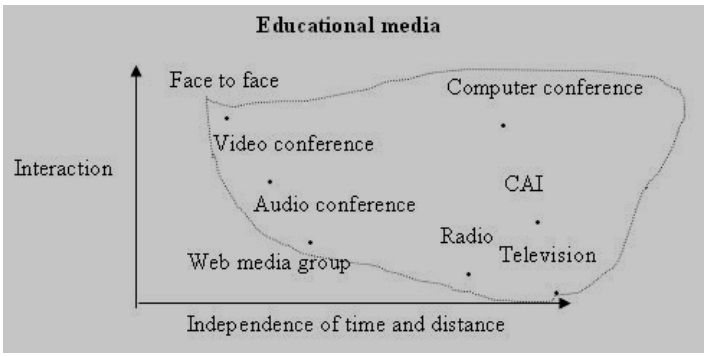

Figure 2: Educational media as grouped by the Web

Figure 2 shows the capability of the Web to support these modalities. As can be seen, all forms of mediated educational interaction are now supported, assuming one adds the use of the Web to enhance classroom-based education. *Figure 3* illustrates different types of educational interaction, which have to be taken into consideration in designing an e-learning system.

To translate these ideas into reality, a model of e-learning is suggested. We are focusing on problem-based learning as the basis for transferring ideas and insights to co-learners – where a problem is used as a knowledge filter, identifying the essential concepts and facts that need to be mastered in order to solve the problem.

It limits the material that must be mastered, thus side-stepping cluttering our head with infrequently used information that over time, will be forgotten. Central to the learning paradigm is a learning center – a place, maybe virtual, maybe real, where learning is facilitated. Web portals present new opportunities for knowledge presentation, i.e. linking learners with gathered and consolidated information.

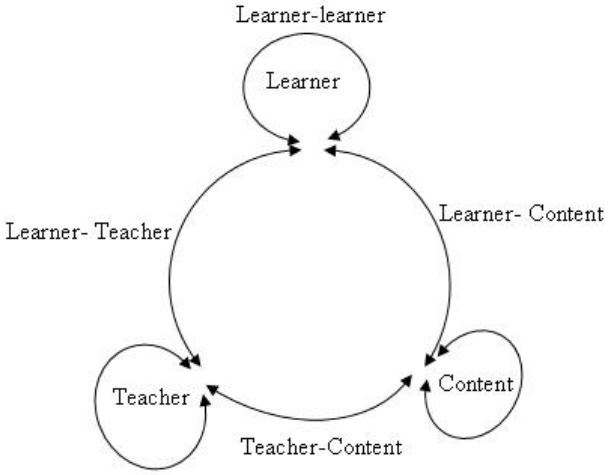

Figure 3: Educational Interactions

Tools that facilitate data harvesting, knowledge consolidation and presentation are key infrastructure elements in our e-learning center. In fact, there are currently almost as many approaches to online course delivery models as there are instructors and instructional designers working on the transition process. [1]

3. Technology Infrastructure

To effectively implement e-learning it is essential to have, a clear understanding of how e-learning will support overall learning objectives, an e-learning content that addresses those objectives, tools to develop, manage and deliver the learning; and a technology infrastructure that will support the tools and the delivery of content.

Figure 4 provides a model that illustrates the two major modes of online learning. The model illustrates the two major human actors – learners and teachers – and their interactions with each other and with the content.

Learners can of course interact directly with content that they find in multiple formats, especially on the Web; however, many choose to have their learning sequenced, directed, and evaluated with the assistance of a teacher. This interaction can take place within a community of inquiry, using a variety of Net-based synchronous and asynchronous activities (video, audio, computer conferencing, chats, or virtual world interaction).

Such environments are particularly rich, and allow for the learning of social skills, a collaborative learning of content and the development of personal relationships among participants.

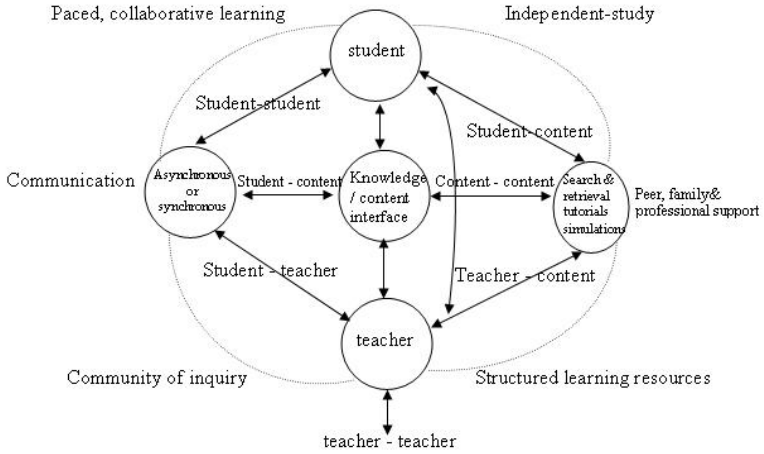

Figure 4: A model of online learning showing types of interaction [8]

However, the community binds learners in time, forcing regular sessions or at least group-paced learning. The second model of learning (on the right) illustrates the structured learning tools associated with independent learning. Common tools used in this mode include computer assisted tutorials, drills, projects and simulations. Virtual labs, an efficient software package in which students complete simulations of lab experiments, and sophisticated search and retrieval tools are also becoming common instruments for individual learning.

The challenge for teachers and course developers working in an online learning context is to construct a learning environment that is simultaneously learning centered, content centered, community centered, and assessment centered.

This discussion highlights the wide and diverse forms of teaching and learning that can be supported on the Web today.

The technology infrastructure must have the necessary capacity to support the demands that e-learning will generate in terms of network load, it must be scalable to support growth, it must be stable to ensure a high level of availability for learners, it must provide an open environment and tools that support the interoperability of the various components in e-learning solutions, and it must provide security to protect distributed users and content. *Fig. 4* shows an online learning system framework.

3.1. Constraints and opportunities presented by the infrastructure

Having an appropriate delivery platform is one of the six “success factors” within the implementation of learning technologies cited by [2]

The e-learning tools available for consideration will depend on bandwidth availability. Ekos and Green identified six types of technology application that are increasingly being considered as potential learning technologies:

- Multimedia: The use of multimedia is steadily growing, particularly as off-the-shelf products become increasingly available. Bandwidth issues will serve to determine whether multimedia tools are made available here or on CD.
- Networked training: Training via corporate Intranets.
- Electronic Performance Support Systems: "Electronic job aids" may require reliable networks for deployment.
- Videoconferencing: Clearly requiring high bandwidth, videoconferencing is growing in three areas: in-house training in decentralized organizations, just-in-time updating, and providing access to resources from external providers.
- Learning Centres: A solution to problems presented by the diversity of resources within an organization, learning centres are being established to provide the required technology in one room.
- Learning Management Systems: Systems such as WebCT require a reliable network on both the client and server sides

Examining bandwidth in closer detail, Horton [3] suggested that each course page should download within 10 seconds. Since this download time will depend on the learner's connection speed, some guidelines for file size, and hence for the development of materials, are:

connection speed is:	Limit each page to a total size of:
56 Kbps	40 K
128 Kbps	80 K
1 Mbps	640 K
Faster	1 Megabyte per Mbps

3.2 Kinds of content will be most appropriate for e-learning development

Some types of content can be considered more readily deliverable via an e-learning platform. While some authors claim that virtually any content can be at least partly delivered via e-learning technologies (e.g. Horton) [3] , it is clear that workplace e-learning has focused on particular kinds of content, which may at least suggest fruitful areas in which to begin such programming.

Research shows that professional, technical, computer and management skills represent more than 70% of actual e-learning content.[3]

Another critical issue related to content is its source: Do we buy or build? A commonly adopted rule of thumb for the development of e-learning materials is 200 hours of development time for one hour of learner time. This ratio expands to 300 hours per hour of learner time for the development of multimedia materials.[3]

Thus, credibility and development time are dual incentives for obtaining either off-the-shelf content or seeking an external vendor for at least a portion of the development.

Ekos and Green [2] cite the increasing availability of off-the-shelf technology-supported training products as a key factor influencing the growth in the use of learning technologies in the workplace. Conversely, the lack of appropriate training materials has been a barrier to the use of learning technologies.

3.3 A blend of technologies appropriated for each program

Blending, such as the mixing of face-to-face and online learning, has become particularly prominent for the transition period. Boettcher and Conrad [4] have identified four general levels of incorporation of online resources into teaching and learning:

- WebCourse: available anytime, anywhere via a browser.
- WebCentric course: shifts focus from the classroom to the Web.
- WebEnhanced course: uses the Web to support a traditional course.
- WebPresence: basic course information is available online.

3.4 Manage the program offerings

In the real world, the functions described above are typically spread across a number of tools and systems. *Figure 5* shows an online learning system framework.

Learning portals bring together the e-learning tools, content and delivery environment and organize them into logical groupings based on the role of the individual accessing the portal. Each organization using a portal will define and organize detailed roles based on their needs, although some common overall roles are seen to be content developer, instructor, advisor, administrator, and learner. Portals are also used to support learning communities, that is, groups of people with interests in a particular topic or subject area. The portal provides a way to identify people with similar interests and provides collaboration tools and content sharing to members of these communities.

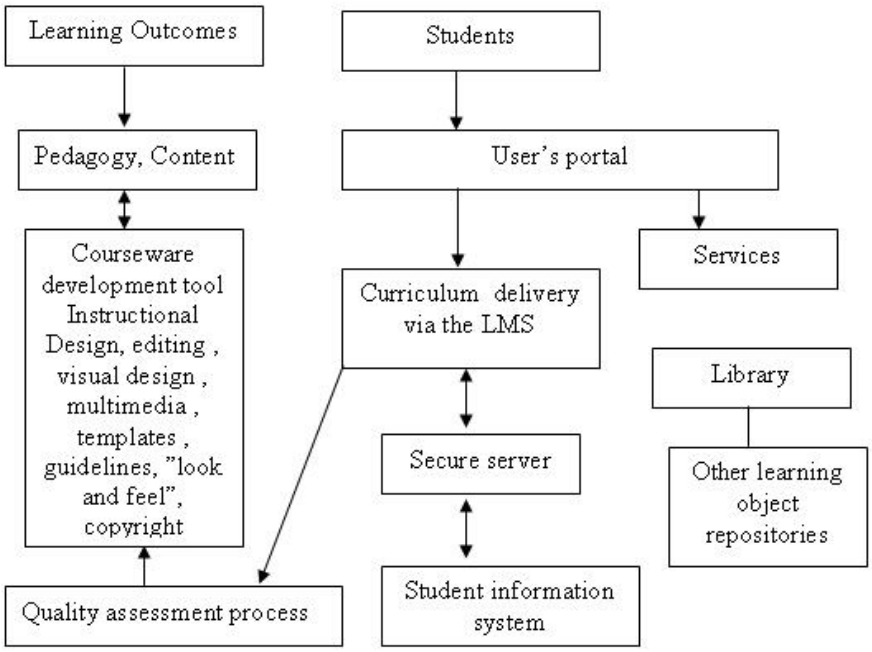

Figure 5: A framework of an online learning system.

In higher education, schools implement these portals as an integral part of the school community and learning environment. Portal technology and services are available from a range of vendors. Content is at the heart of the e-learning environment. In the academic field, particularly at the higher levels of teaching, publishers are making content available in most subject areas. They are repurposing their existing content for Web delivery as "course packs" or "cartridges" that run on widely used course management systems such as WebCT and Blackboard.

4. Developing An Infrastructure For Online Learning

Referring to *Figure 5*, learning outcomes (i) are translated into course content, resources and an approach to the teaching and learning process that will enable a student to achieve those outcomes. Once these basic parameters have been thought through, the courseware development team (ii) will share the responsibility of translating the theory and intentions into courseware and online learning functions to be delivered by the learning management system (LMS) (iii), which interfaces with the library and other digital resources (iv), related services (v), and the student information system (SIS) (vi) through a secure server (vii) that can authenticate the student user name and pass word. From the students' point of view, they will connect to the LMS and the related services through a user-friendly users' portal (viii), so

that, with a single login, they can gain access to their courses and can be linked to all related resources and services. Finally, to ensure ongoing improvement, an evaluation process for the effectiveness of the system, based on learning outcomes and students' feedback, will be set up in the form of an independent quality assessment process (ix), which also feeds back into the development cycle.

In a learner-centred approach, as articulated by Lau [5], "The move to outcome-based and competency-based education in recent years also highlights the need for considering content as a resource for learning rather than the focus of learning. … Consequently, the students are the ones who must make most of the choices about which learning material to use and how to use it."

This learner-centered approach contrasts somewhat with a more pragmatic approach, as articulated by workplace e-learning consultant Gloria Gery [5]: "Even if people truly need to learn what we think they do, if they are presented with too much content, they will shut down and ignore it. They cannot, or will not, filter content. We must do it for them."

A key to resolving this issue of content volume and access may be to provide clear access points, perhaps based on self-testing. Learning sequences such as learner-customized tutorials and knowledge-based tutorials can accomplish this (Horton) [6].

The author is participating in two projects under development: one for the K-12 education, started in 1998 and one for higher education which starts in 2004 in the Delta Academy. The K-12 project will develop experimental prototype that will link eight schools across the country, with only two courses: Mathematics and science. The project starts in 1998, and five working groups are working in the project, being divided as follows:

- A hardware group to investigate learning centre design and the network linking of the eight centres.
- A software group to decide upon the software package necessary for management, content development, assessment….etc
- A educator or content development team formed from the course professor, pedagogical expert, and a developer.
- A assessment team to build an assessment database suitable for online learning.
- A Management staff to link and supervise all the activities.

5. Components of the System

5.1 Learning Management System (LMS)

Another key decision to be made at the development phase is the choice of LMS. The first question to be considered in this decision is whether to use imported proprietary software or to develop an in-house system (which may or may not be based on freely available, imported, open-source software). Many very good and comprehensive proprietary packages are available; some come as an add-on to the SIS, and others can be interfaced with the system. Staff can be oriented to and updated on the

software's development and functionality at training events, conferences and meetings. Assessing which of the available proprietary options is the one best suited to the needs of a particular online learning system can be an onerous task, and choices needs be carefully considered indeed, they are often made with the help of an independent evaluation source.

Full-featured Learning Management Systems have to provide the following:

- A learner profile manager
- Learning offering catalogue manager
- Learning planner
- Learner registrar
- Connection to the delivery environment for delivery of study/learning offerings
- Delivery/participation tracking
- Assessment and testing tracking
- Assessment authoring tools
- A content assembler

In essence, these will serve to manage the learning environment, providing a place where content can be organized and presented to learners, where learning plans can be managed, and where learning activities and results are tracked.

In higher education learning management system functionality is provided by the integration of a course delivery management system with a student administration system. The student administration system will manage the learner profiles, an offering.

There is catalogue, learner planning, and learner registration. The course delivery management system manages the content assembly, and also interacts.

5.2 Learning Content Management System (LCMS)

An LCMS is a multi-user environment where learning developers can create, store, reuse, manage, and deliver digital learning content from a central object repository. Whereas an LMS manages the processes surrounding learning, and LCMS manages the process of creating and delivering learning content, just as the names indicate.

The features of typical LCMS products include:

- Content Assembly tools
- Learning Content authoring tools which may be included with the LCMS
- Authoring tool integration that supports the registration, storage, and retrieval of objects by any standards-conformant authoring tool
- A metadata-enabled content repository (including storage devices with some content management functionality and an offering catalogue)
- A simple learner profile manager although these are becoming more sophisticated in LCMS products
- A content delivery system that allows the LCMS to locate, retrieve, and serve up the appropriate objects to the delivery environment.

Many LCMS products integrate all of these components and are based on instructional design paradigms or instructional theories. Another tool found in some

LCMS products is one used for 'repurposing' informal or legacy content, which in plain English means converting StarOffice, PowerPoint, or Word documents into learning objects that can be used by an LCMS.

5.3 Library and Digital Resources

Linking the course or program LMS to the necessary online resources is a key element of any online system. Institutional and public libraries have been leaders in the development of systems and protocols to acquire and share resources. Many now have electronic gateways to their own holdings, to those housed elsewhere, to digital databases of journals, magazines, and government publications (including much in the way of full-text materials) and to specially developed supplementary databases of materials selected for a particular course. In addition, learning objects will become increasingly more accessible to persons through in-house and external digital repositories.

5.4 Learner Services

In online learning, most attention is always gieven to the courseware and delivery platform. Depending on the enterprise involved, such supports would include technical help, educational advising, various forms of counseling, services for learners with special needs, and so on.

5.5 Interface with the Student Information System (SIS)

Ideally, the LMS is linked to the SIS in such a manner that the right student is automatically in the right course at the right time, and that all the right student information is easily available to the right instructor and any other authorized person. The instructor should be able to manipulate student data as needed for the course and to contact the students as a group, in sub-groups and individually.

All this requires clever and robust programming in the LMS, a server used to authenticate student log-ins and ensure a secure interface with the SIS and also appropriate programming in the SIS itself.

5.6 The Users' Portal

The portal should allow the learner, with one secure login, to access everything that is of interest to them: the LMS, their grades and other applicable documentation on their student file, along with related learner services and accounts. It will also allow persons to customize their portal Web page to be a unique interface, depicting their own preferences and allowing them to link easily with other learners and staff, related services as well as the student association.

5.6 Quality Assessment

The development of an e-learning system should include a plan for the independent evaluation of all aspects of the system, and especially of the degree to

which it enables or enhances the achievement of the stated learning outcomes. In developing an infrastructure that supports excellence in online learning, the issues to be addressed are a clear understanding of the goals of the curriculum and of the characteristics and needs of intended students and, with this a healthy working environment with a committed staff, where implementation can proceed and where constant change is understood to be the norm. Within these general areas, there are, of course, a host of technical, procedural, and policy decisions to be made, but online learning is now mature enough that such decisions need not be made haphazardly: plenty of research and information is available, and there are many successful examples of online learning systems to learn from: white new contributors can focus on getting basic principles and goals in order before proceeding onto implementation. All levels of education stand to benefit from what the Internet has to offer.

5.8 Assessment and Testing Engines

Assessment and testing may be integrated with learning content and delivered with it, or it could be managed as a separate process. In either case, assessment and testing are vital components of any educational environment – and the storage, assembly, delivery, and recording of assessments is often handled by an independent component called an assessment engine.

Assessment engines typically include assessment authoring capabilities and can be used to create question banks from which assessments (and surveys) are assembled.

The assembly process can include random selection of questions based on criteria and even the adaptive selection of questions based on previous results. The types of questions the can be supported by assessment engines is impressively large, although straightforward multiple choice questions with a single correct answer still dominate. Assessment engines provide specialized authoring tools designed specifically to create surveys, tests, and assessments. Most assessment engines also support the delivery of assessments to learners, and the reporting of results back to a learning management system. Some tools maintain their own database of results for reporting and analysis.

Assessment engines are included in many content authoring and assembly tools, and also course management systems. There are also specialized assessment engines – such as Question Mark or Quiz Studio – that focus solely on the creation, delivery, and tracking of assessments. These specialized tools interoperate with a range of LMS, course management, and delivery environments

6. Adoption in the Education Industry

The internet and e-learning in general are beginning to make inroads into the K-12 learning process. The key challenges to be overcome are:

Development of a curriculum in which e-learning plays an integral and useful part, there is teacher training and involvement, access to infrastructure (computers and high-speed internet connections) and funding.

In general, higher education institutions are better positioned to make use of e-learning technology than K-12. College students have better access to personal computers and the internet, and the institutions generally have a stronger technology infrastructure and support staff available to them.

Conclusion

When building or selecting e-learning products or technology infrastructure components, the following requirements should be considered.

Interoperability and Conformance/Compliance with Standards Interoperability between content and system components is key to the successful implementation of an e-learning environment.

The goal of seamless integration extends beyond the individual components that comprise the e-learning architecture.

An e-learning architecture must be able to integrate with all backend application systems—including human resources, finance, performance management, knowledge management, entitlements, and security—as well as the overall network infrastructure.

We believe that face-to-face education is still needed for psychological reasons. Concepts like emotion, friendship, sympathy, aggression, all human factors are essential to shaping the character of a learner. Students learn behaviours, creativity, facts, judgment, language, observation, procedures/processes, systems, reasoning, skills, theories, emotions and other things in face-to-face education. However, computers and software can be used as tools to modify our way of teaching and allow a teacher to expose more topics to students. While and guiding him/her in searching needed information software packages like MATLAB, MATHCAD, AUTOCAD, SAD, SPSS, LABVIEW, helps a lot to avoid the unnecessary burden of dealing with matrices, differential equations and graphics necessary in solving many engineering problems.

References

1. Berger, C. & Kam, R. (1996). Definitions of Instructional Design. Available: http://www.umich.edu/~ed626/define.html
2. Ekos Research Associates, & Lyndsay Green & Associates (1999). The Impact of Technologies on Learning in the Workplace: Final Report. Available: http://olt-bta.hrdc-drhc.gc.ca/publicat/index.html
3. Horton, W. (2000). Designing Web-Based Training: How to Teach Anyone Anything Anywhere Anytime. New York: John Wiley & Sons, Inc. Available: http://www.horton.com/DesigningWBT/
4. Boettcher, J. V. & Conrad, R-M. (1999). Faculty Guide for Moving Teaching and Learning to the Web. Mission Viejo, CA: League for Innovation in Community Colleges.

5 Lau, R. S. M. (2000). Issues and outlook of e-learning. South Dakota Business Review, 59 (2), 1-4.

6. http://www.horton.com/DesigningWBT/
7. Martin, R. (1997). Key issues in transitioning from distance education to distributed learning. Available: http://www.fcae.nova.edu/disted/spring98/martin.html
8. Terry Anderson et al. Athabasca University „e-Learning Application Infrastructure", Sun Microsystems, Inc.