DISTANCE LEARNING FOR MOBILE INTERNET USERS

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ABSTRACT

This paper provides an overview on the current state of art in the field of Distance learning for mobile users. It mentions a large range of technologies, services and approaches that may be used to bring distance learning to mobile internet users. These technologies are supposed to considerably increase innovative e-learning solutions for the next generation. While this definitely appears to be true, I think what is not so clear are the implications for students, and lecturers etc. In this article I first evaluate distributed e-learning technologies. With some of the most vital topics, focusing on adaptive distributed e-learning for Mobile Internet Users (MIUs). I also provide a brief analysis of Broadband Network Services, Collaborative e-Learning Tools and Distributed Virtual Environments, Internet-Based Adaptive Learning Technologies and Personalised Distance Learning.

I continue my discussion on to Internet Development Tools (IDTs) for Distance Learning Solutions, Learning Technologies for MIUs, Semantic and Web-Based Services for Enriching Learning Interactivity, and Evaluations of Distributed Learning Technologies (DLTs).

Keywords: Web based services; mobile internet technologies; broadband network services; e-learning tools,semantic web technology; mobile internet user.

List of Acronyms

BNP	**B**roadband **N**etwork **P**latform
DLTs	**D**istributed **L**earning **T**echnologie**s**
GPRS	**G**eneral **P**acket **R**adio **S**ervice
IP	**I**nternet **P**rotocol
IT	**I**nformation **T**echnology
IDTs	**I**nternet **D**evelopment **T**ool**s**
MITs	**M**obile **I**nternet **T**echnologie**s**
MIU	**M**obile **I**nternet **U**ser
PDA	**P**ersonal **D**igital **A**ssistant
SWT	**S**emantic **W**eb **T**echnology
VoIP	**V**oice-**o**ver-**IP**
WWW	**W**orld **W**ide **W**eb

INTRODUCTION

It is clear that with the availability and speed of Internet access and computing platforms, there has been a dramatic increase in the opportunity for the use of collaborative environments and other distributed learning technologies. For example, learning tutorials, these days, are delivered via a range of technologies such as the internet, smart boards, television, videotape, intelligent tutoring systems, and computer-based training. As a result, a wide range of new products are being developed. New categories of products continue to emerge i.e. Mobile Internet Technology (MIT) which involve devices used to convey information to the mobile user. These devices include a variety of cell phones, Personal Digital Assistants

(PDAs), laptops computers, etc. Basically, MIT is the communication between the information repository and the mobile device. The wireless networks provide the communication connectivity through wireless applications that are the combinations of mark-up languages, communication protocols, and user interfaces.

In my view one of the key players in this arena is the Broadband Network Platform (BNP) (Figure: 1) providing development of knowledge-based global, national, regional, and local economies. Application of MIT facilitates on-demand creation, evaluation and evolution of learning materials based on effective retrieval, feedback, and reuse support.

BROADBAND NETWORK SERVICES

Broadband connectivity is a key component in Information Technology (IT) development, adoption and use. It is of strategic importance to all organisations because of its ability to accelerate the economic growth in all sectors. Moreover, its contribution to MIT can enhance social and cultural development, and facilitate innovation (Uther, 2002). In addition, widespread and affordable access can also contribute to productivity and growth through applications.

When considering the private sector, broadband can be an enabler of e-business and new market opportunities which can realise growth through productivity from improved information exchange, value chain transformation, and process efficiency. For the public sector, we can all see how broadband can improve the efficiency, availability and reach of services in areas of high government interest, such as health, education and government services. We can take advantage of broadband services to enhance the quality of our lives, through economic, social and cultural, development. Rural and remote communities can really benefit with economic and social inclusion. Moreover, broadband services can facilitate access to new and advanced goods and services to participate in the digital economy and information society (Collis, 1996).

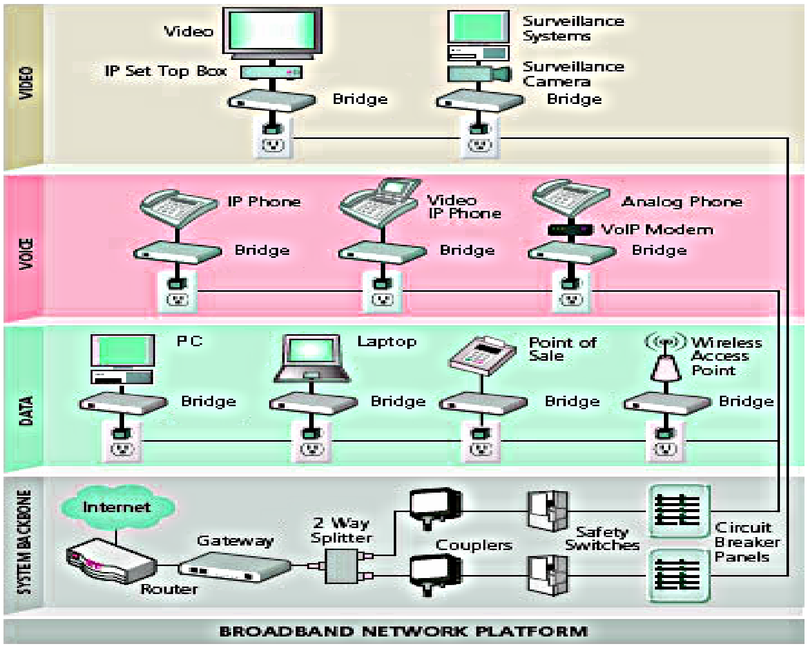

Figure: 1
Broadband Network Platform
Source: http://www.telkoplc.net

I see this as the beginning, where all kinds of new and existing information and voice and data services are able to transmit across heterogeneous networks. Moreover, these networks are able to transmit information uniformly from the provider to the subscriber through a core packet-switched network.

I foresee there will be challenges with the next generation technologies and platforms that will require adaptivity in complex networking environments. One can say that it is a subset of the larger world of IT. Adaptivity is a requirement for seamless multi-system and multi-network interoperation. This interoperation is needed to provide a vital competitive advantage for service providers and/or operators. Moreover, protocol-based integration with different gateway and conversion technologies will be required to adapt to different signalling and transporting protocols. For example VoIP gateways and signalling gateways will be required to adapt to mobile-fixed service convergence.

COLLABORATIVE E-LEARNING TOOLS AND DISTRIBUTED VIRTUAL ENVIRONMENTS

One of the important characteristics of MIT is its focus on collaborative approaches for all relevant e-learning settings. This is where its major strength lies. This virtually, covers the whole bandwidth of e-learning settings. Moreover, it includes short-term problem-solving through quick information access, as well as long-term competence development through dedicated web-based training, tutoring and mentoring. The collaborative tools (Figure 3.0.1) include an instant messenger, a conference chat system, a shared white board, a remote demonstration system, and two-way video (Blank, et. al., 2001). In addition, a text mining and visualization tool enables students to identify and explore emerging technology trends.

For the training service provider, the virtual classroom scenario offers a viable alternative to classical in-class training settings (Jesshope, et. al.). However, the effectiveness of virtual classes should be judged through the effective support of web-based experience sharing, and the establishment of a network of geographically distributed learners and trainers.

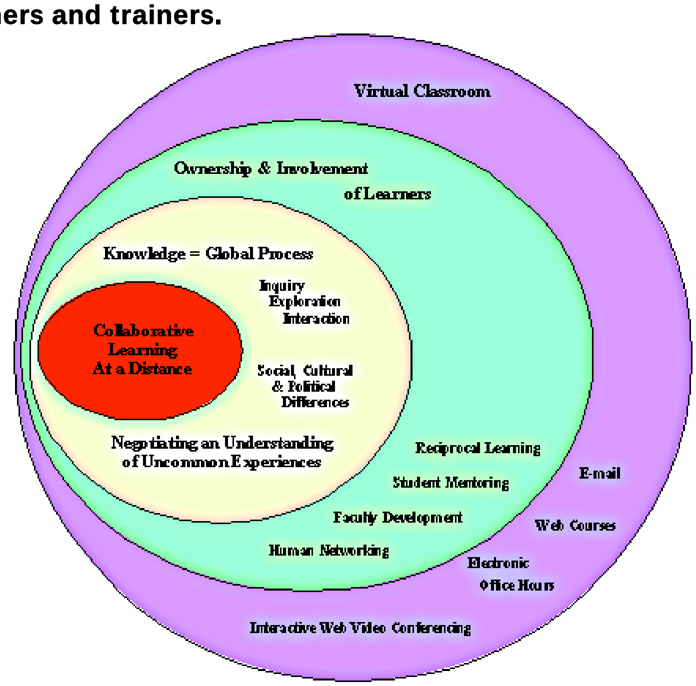

Figure: 2 Model of e-Learning
Source: http://www.aabss.org

I have discovered that in order to support high bandwidth information exchanges between participants, the framework for collaborative tools uses a peer-to-peer communication scheme instead of the traditional client-server model.
A server is still used, but it only maintains the global state information (e.g., availability) of participants. The communication between participants is handled by direct, peer-to-peer connections over Internet Protocol (IP). Each peer in this configuration has a communication component and a set of upper-level collaboration tools. The communication component communicates with the collaboration tools (Stahl, et. al., 1995) through shared memory, and acts as a communication broker. I believe this design provides a simple interface to collaboration tools for communication management, maintaining the IP connection list among peers.

MIT helps to establish e-learning networks in which people of equal and different competence levels practice both individual and group e-learning. However, since high-level collaborative culture makes it easy to establish e-learning networks (Blank, et. al., 2001), e-learning managers should concentrate on initiating the cultural changes that are necessary for the introduction and maintenance of collaborative e-learning processes. Through MIT, knowledge creation, knowledge structuring and knowledge dissemination can benefit from e-learning networks and their associated collaborative e-learning processes. This, in turn can be, systematically, capitalised by an individual by gaining expertise during collaborative e-learning. An organisation should strive towards achieving collaborative culture, in order to fully benefit from all the functionality designed especially for collaborative e-learning.

INTERNET-BASED ADAPTIVE LEARNING TECHNOLOGIES AND PERSONALISED DISTANCE LEARNING

Personalised support for learners becomes more important with open and dynamic e-learning and information networks for MIUs (Uther, 2002). Semantic Web Technologies (SWTs) based distributed learning environments (Figure 4.0.1) realise this. I propose a service-based architecture for existing and current adaptive educational systems with well-established personalisation functionality, and open, dynamic learning repository to establish personalised e-learning for MIUs. Personalisation functionality will be provided by various web-services. In turn, this will integrate personalisation services and other supporting services. This will also provide the personalised access to learning resources in an e-learning network for MIUs. Moreover, adaptive learning will be presented to the learner in an order and will depend on the results of pre-assessment and post-assessment of the learner's mastery of the content knowledge and reusable intelligent learning activities. Here, the goal will be to close the gap between the currently popular approach to Web-based education and the powerful but underused technologies in intelligent tutoring for MIUs. This architecture will address the component-based assembly as well as teacher-level reusability of adaptive systems for MIUs.

Service-based architecture, for adaptive e-learning, will allow the building of a distributed architecture for adaptive e-learning based on reusable intelligent learning activities. This will address both the component-based development of adaptive systems and the teacher-level reusability. This, in turn, will attempt to approach Web-based education based on repositories of educational material.

Over time several IT groups have added and redesigned several components and refined the architecture for MIT. However, to present the architecture, review experience, and analyse several problems that have to be addressed in the future work, requires some solid practical experience with the distributed architecture for MIUs and also the need to compare it with other MIT solutions.

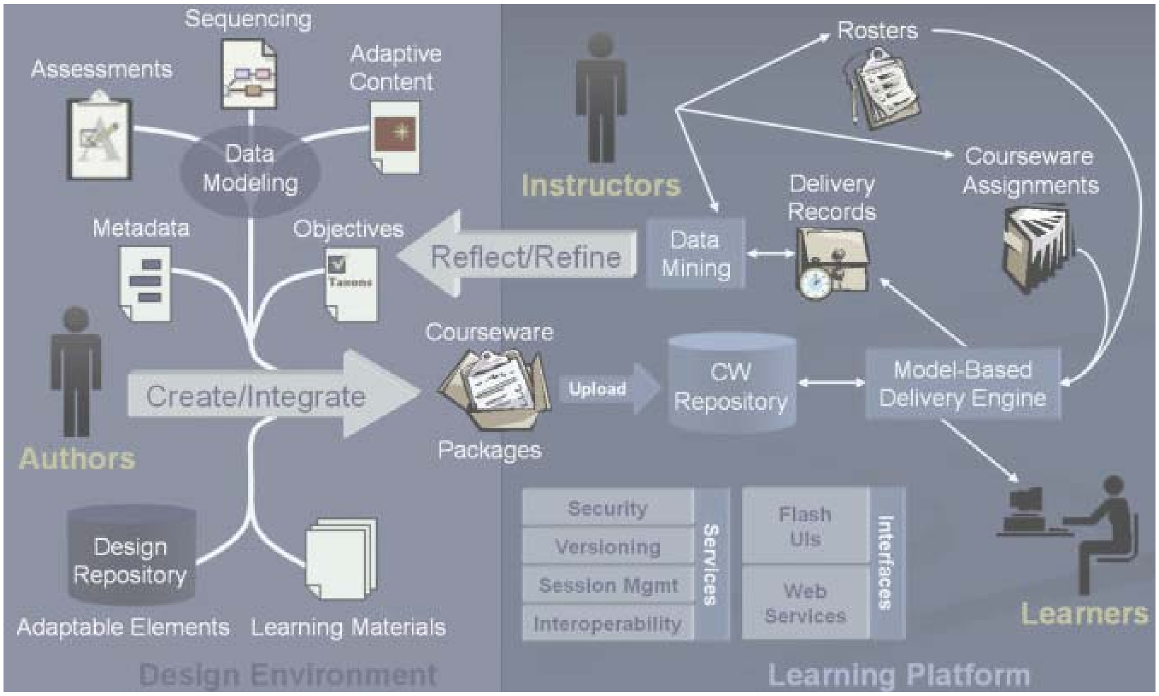

Figure: 3 Model of e-Learning Environments
Source: http://www.isis.vanderbilt.edu

INTERNET DEVELOPMENT TOOLS (IDTS) FOR DISTANCE LEARNING SOLUTIONS

E-learning, using Web-based tools as virtual schools or classrooms and the Internet as the primary delivery mechanism, has increasingly captured the enthusiasm of educators(including myself) and students. E-learning software systems, now, have started to be franchised. However, few of them have successfully taken advantage of currently available MITs. MIT can provide easy access to a huge and interlinked network of scientific data. MIT can also help in enabling advanced graphical tools and computational power to visualise scientific data and processes. The data exploration and mining tools are some of the examples, which can help students to better understand the characteristics of the data (Stahl, et. al., 1995).

User data integration tools will allow students to input and merge field observation data. With the achieved or published data, learning activities can happen on the MIT platform. In turn, this will create active participants in inquiry and cooperative learning. In my view this will be significant to the science of e-learning through MIT.
The development of these new functionalities for MIT will support theoretical and empirical research in the science of e-learning. In turn, the prototype IDTs will be developed for specific research and e-learning projects. The design ideas can, then, be easily transportable to future developments of generic and commercialised e-learning software packages (Collis, 1996). Moreover, it will go beyond the capability of a specific e-learning software system to create a collaborative and creative online learning environment (Jesshope, et. al.). However, the biggest challenges will be to access the vast and interlinked network of scientific data, and to handle meta-knowledge (Kemppainen, 2000). The simple reason is that there are already good Internet projects and resources for e-learning, and there is an almost endless list of really great sites out there; therefore, it will be hard to decide which sites to review

for specific topics. There is an urgent need for cooperation between IT communities that share the interest in e-learning.

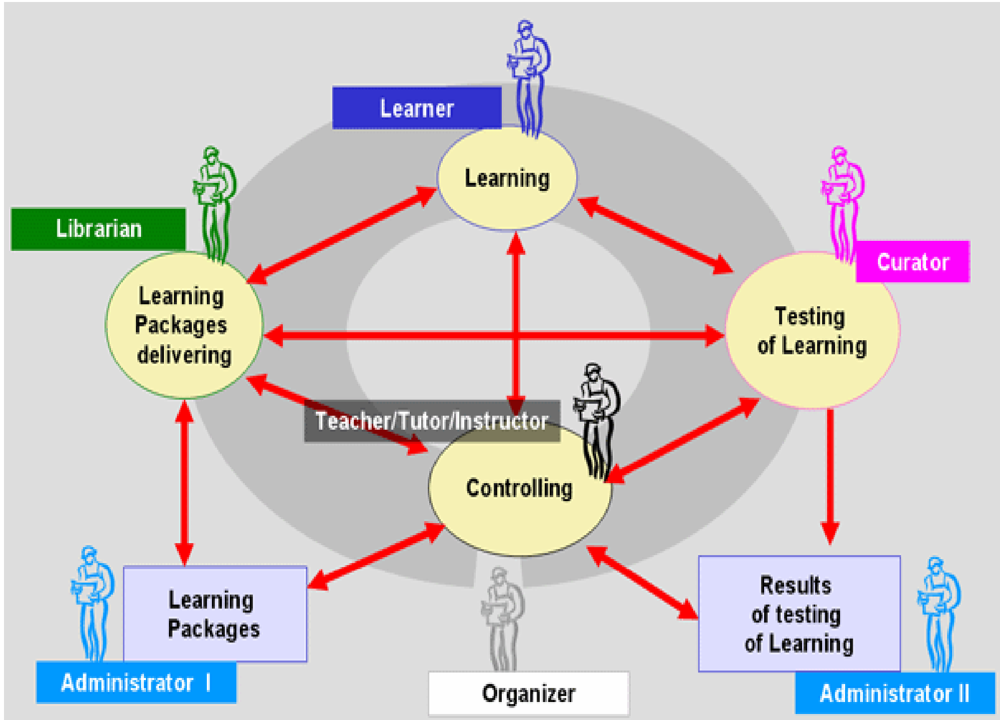

Figure: 4 Dimension of Learning and Training
Source: http://www.stel.ru

However, there is hope in the form of the U.S. National Science Foundation. This Foundation has launched National SMET (Science, Mathematics, Engineering and Technology) Education Digital Library Program (http://www.ehr.nsf.gov and http://www.smete.org).

This program plans to offer direct access to and delivery of instructional resources through the SMET digital libraries. The program is developing various tools, such as search tools, meta-data tools, learning object management tools, and community building tools. These tools will allow MIUs to learn, connect and manage their personal educational portfolio.

E-learning is defined more narrowly than distance learning in a sense that the text-based learning and courses are conducted via written correspondence. However, e-learning is inclusive and synonymous to all computer-related applications, tools and processes. These have been strategically aligned to value-added learning, teaching processes, and collaborative tools that are designed to facilitate interaction and communication among online learners.

Technology-based e-learning covers a wide set of applications and processes (Blank, et. al., 2001), including computer-based learning, web-based learning, virtual classrooms, and digital collaborations. The delivery of the content is via all electronic media, including the Internet, intranets, extranets, satellite broadcast, audio/video tape, interactive TV and CD/DVD-ROM. However, I feel there is a requirement for a second generation e-learning pedagogy model that illustrates a more determined approach to e-learning and that matches the MIT's capabilities and tools.

LEARNING TECHNOLOGIES FOR MIUS

I believe that the next generation of e-learning will be by mobile learning (m-learning). This dimension of learning and training (Figure 6.0.1) is due to the recent developments of wireless communication technology (Koschmann, 1996).

The E-learning domain will make the effort to incorporate MIT in the hope of replacing the wired computer scenarios of today's e-learning. Already, there are moves towards introducing an enhanced learning approach. This is, generally, based on a paradigm that focuses on the learner and on new forms of learning (Koschmann, 1996). However, the learner will have an active and central role in the learning process as well as activities. This will facilitate MIUs' construction of knowledge and skills.

Wireless technologies will have a major role to play in this approach since they are supposed to provide the next generation of MITs for MIUs. To achieve this vision requires the merger between mobile and SWTs in a way that provides relevant complementary features that can address the requirements of next generation e-learning applications. The aim, here, will be to aid the integration and use the MIT into the main teaching and learning activities for the MIUs.

The most, obvious, advantage of m-learning will be its ability to access information anywhere and anytime. Moreover, real time scenario and problem based learning activities can be conducted in the application environment through the use of mobile devices.

For example, a training session can be controlled centrally by using global positioning systems (GPS) to track and record participant's movements and actions. The main advantage, here, will be the collaboration between the participants, that will share the information and questions resulting in the possibility of an increase in appeal with the interactive nature of the media compared to a text book, and the ability to provide some context by observing people in locations.

The debate and action agenda regarding e-learning is rapidly shifting to the quality and context of MIT applications. For students, the use of MIT can improve educational achievement and increase motivation to stay in school. For adults, MIT can help meet a range of educational goals. Specifically, the introduction of digital libraries can support e-learning opportunities.

This can, in turn, lead learners to think about what they need in terms of course materials. Moreover, the use of MIT in educational digital libraries can help to gain knowledge. At the same time it can be used as a stimulus for discussion as well. The possibilities are endless.

There is a growing overlap of IDTs that provide the information from sources consolidated in one place. A problem is emerging for the typically broadband internet in the form of wireless access to a networked e-learning environment. In my opinion the solution will need to integrate with a wide variety of other technologies. It will also need to recognise standards for information exchange and adopt a Web Services model that can be assessed both in terms of product quality and in terms of the quality of the e-learning experience. Though these do overlap in some respects, it is not solely based on the quality of the MIT but also on the conceptual basis upon which the e-learning experience is going to be constructed. Moreover, the quality related aspects of a conceptual framework for m-learning need to be adopted to assess the quality of m-learning application.

SEMANTIC AND WEB-BASED SERVICES FOR ENRICHING LEARNING INTERACTIVITY, ANNOTATION, COMMUNITY-BASED ACTIVITIES, AND REFLECTION

In e-learning, curriculum material and instructional strategies ideally should be tailored to the abilities and aptitudes of different types of learners (Campbell and Bourne, 1997). Here, the overall objective should be to interact with instructional materials through experimentation and reflection and develop an advanced learning environment. However, in the framework of MIT, an advanced learning environment will act as the main hub of resources available in the developed network that will serve as distributor of information and organiser of suitable learning activities (Kemppainen, 2000). This will also involve an element of excitement and interactivity by setting a communication channel between the students, enabling informal and formal learning experiences to be blended together. In addition, to enriching the learning opportunities, such blending can help meet the challenge of providing education opportunities tailored to diverse and heterogeneous populations of future students.

If the normal web, we browse on a daily basis, can be seen as a huge repository of information, the semantic web consists of a meta layer built on top, in order to describe the information more meaningful to an automated agent. It is also possible to use a search action that is informed by this meta layer above the web. This, in turn, will point to resources on the web or in the real world. One can look for the information, and retrieve only results that correspond to the class of entities within the semantic metadata.(figure 7.0.1)

It seems to me that there are attempts to merge the concept of structured learning construction with the aim of supporting the MIT. In fact, there are tools that can benefit SWTs in order to implement digital pedagogical issues or applications. However, the Web has a primary role in the delivery of this just-in-time education to learners.

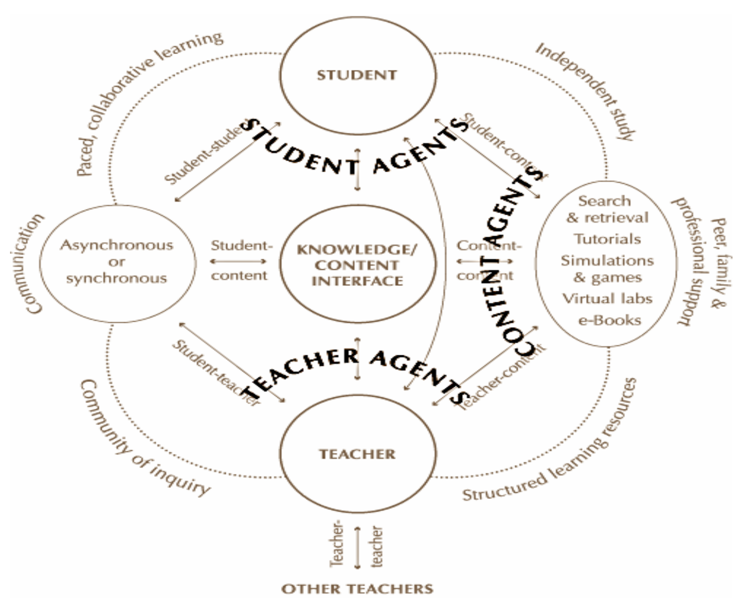

Figure: 5. On-Line Learning and Semantic Web
Source: http://www.athabascau.ca

In fact, a number of different Web-based systems have grown with the aim of supporting the MIT. This means that structured learning construction, which can be abstracted from everyday use, is actually the place where MIT's essence lies. In other words, the semantic nature of the MIT constitutes the language phenomena as a whole. This means that the parts of MIT are obtained from SWT within a wider system.

EVALUATIONS OF DISTRIBUTED LEARNING TECHNOLOGIES (DLTs)

The emergence of the Internet has attracted academic and non-academic institutions to the distributed learning (Figure 8.0.1) arena. Most of the instructional designers are knowledgeable about the Internet and digital technologies to design distributed learning activities (Campbell and Bourne, 1997). They can incorporate instructional strategies and techniques best suited for the selected audience. I believe that to improve the effectiveness of distributed learning materials, several phases of evaluation must be conducted during the overall distributed learning process. By conducting evaluation, one can improve the DLT product as it is being developed. However, instructional designer and interface designers are the evaluation specialist who can communicate with the design and production teams for revising the course materials. Also, it can provide important feedback, which can be used by the design and development team to revise the course materials for improvement. This improvement must develop a greater capacity to support teaching and learning for the integrated distributed model (Jesshope, et. al.).

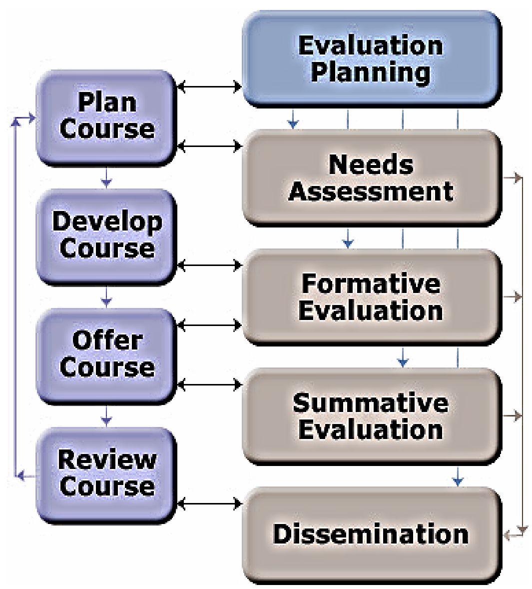

Figure: 6 Distributed Learning
Source: http://www.atl.ualberta.ca

Most evaluations of DLTs will use qualitative evaluations. For example, learners may be asked to rate how much they liked specific aspects of the distributed learning or trained observers may record what happens while learners are working. A few evaluations of DLTs will track grades or other course performance measures, and then ask the instructor an opinion. Fewer will use the data from a comparison group, for example another section in particular year's course. I have come across a multitude of evaluation studies, with only a few that are specific to DLTs provide a comparison group and quantitative results.

Yet, fewer still include student comments or grades to look at for a return on investment issues. Distributed learning needs better evaluation to progress.

CONCLUSION

The explosive growth of broadband networks has carved a new trend of information, voice and data services. Many learning and technology professionals believe that MIT is now an integral part of a complete learning environment. Web-based delivery of course materials does provide students with an interactive multimedia environment, and developers with a framework for managing, authoring, monitoring and evaluating multimedia. Moreover, the MIT framework lets students go beyond the lessons through collaboration with experts (e.g., instructors, researchers and other student) as well as through tools that allow the student to explore current research trends in course-related literature. Although an increasing number of educators are adopting and incorporating MIT in their instruction, only very few of them are fully exploiting its capabilities to transform and extend their pedagogical models.

The next challenge is to access MIT services through mobile devices in a transparent and efficient way. As the number of MIUs is increasing, demand for MIT's support is also increasing. This presents a greater challenge for search and retrieval of relevant IT. The MIT integrates a complex series of functionalities that represents the authoring process a teacher is involved with, and an environment that is Web-based and ever-changing. However, the key to a significant contribution to the MIT growth lies in the ability to make the best use of structured learning as an indispensable activity. In conclusion, new developments in the MITs provide the opportunities to create well designed, learner-centred, engaging, interactive, affordable, efficient, easily accessible, flexible, and meaningful DLTs.

In a distance learning environment, finding a way to improve learning and teaching efficiency is still an open problem. Currently, I am working on applying the MIT to a real learning environment. The MIT system is going to be gradually deployed into our College distance learning system. Then, I will observe and record the effect of the system on teaching and learning in the near future.

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