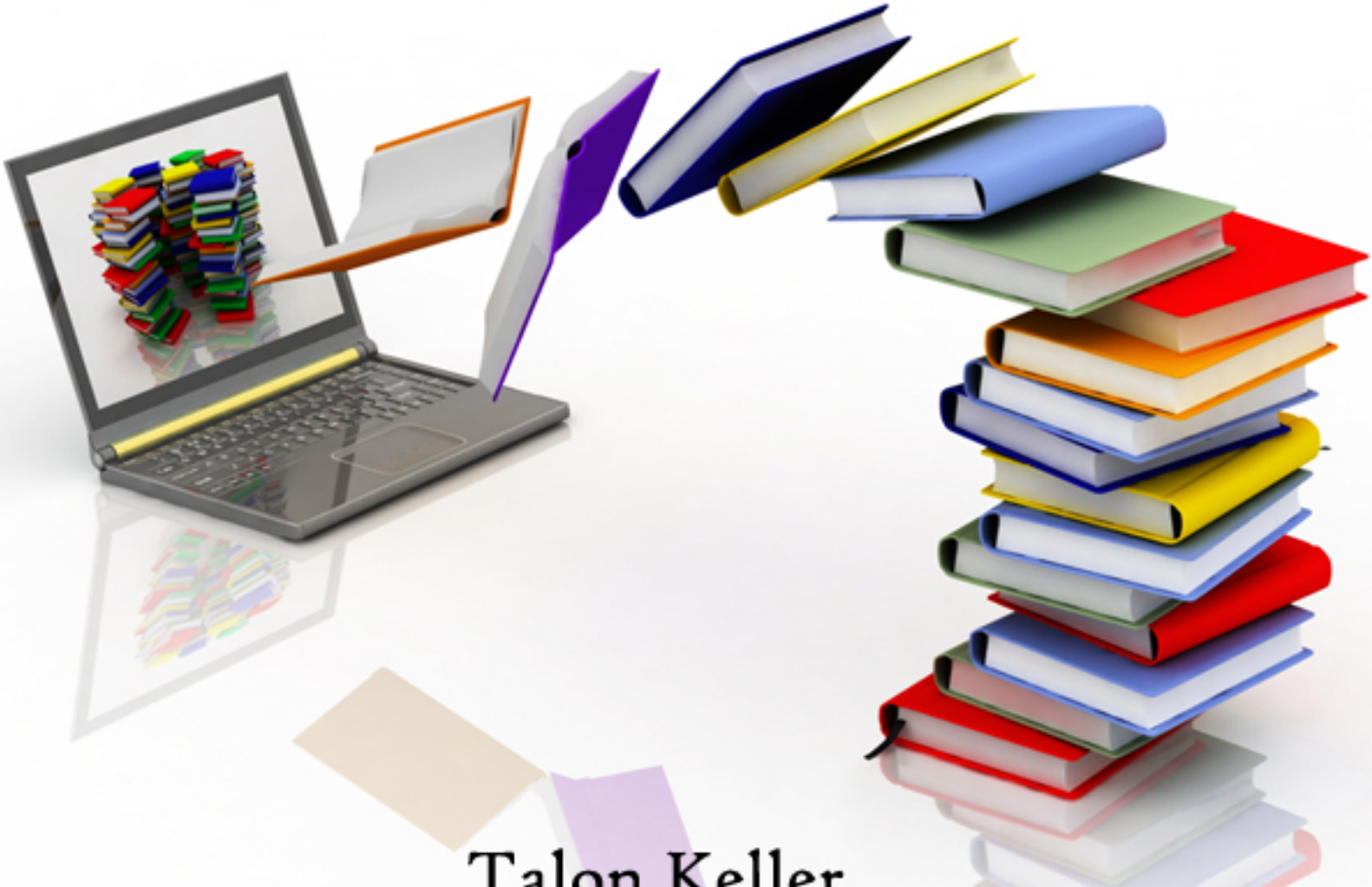
Know All About

E-learning



Talon Keller

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Chapter- 1

E-learning

E-learning comprises all forms of electronically supported learning and teaching. The Information and communication systems, whether networked or not, serve as specific media to implement the learning process.

E-learning is essentially the computer and network-enabled transfer of skills and knowledge. E-learning applications and processes include Web-based learning, computer-based learning, virtual classroom opportunities and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, and CD-ROM. It can be self-paced or instructor-led and includes media in the form of text, image, animation, streaming video and audio.

Acronyms like CBT (*Computer-Based Training*), IBT (*Internet-Based Training*) or WBT (*Web-Based Training*) have been used as synonyms to e-learning. Today one can still find these terms being used, along with variations of e-learning such as elearning, Elearning, and eLearning.

Market

The worldwide e-learning industry is estimated to be worth over $48 billion US according to conservative estimates. Developments in internet and multimedia technologies are the basic enabler of e-learning, with consulting, content, technologies, services and support being identified as the five key sectors of the e-learning industry.

Higher education

By 2006, 3.5 million students were participating in on-line learning at institutions of higher education in the United States. According to the Sloan Foundation reports, there has been an increase of around 12–14 per cent per year on average in enrollments for fully online learning over the five years 2004–2009 in the US post-secondary system, compared with an average of approximately 2 per cent increase per year in enrollments overall. Allen and Seamen (2009) claim that almost a quarter of all students in post-secondary education were taking fully online courses in 2008, and a report by Ambient Insight Research suggests that in 2009, 44 per cent of

post-secondary students in the USA were taking some or all of their courses online, and projected that this figure would rise to 81 per cent by 2014. Thus it can be seen that e-learning is moving rapidly from the margins to being a predominant form of post-secondary education, at least in the USA.

Many higher education, for-profit institutions, now offer on-line classes. By contrast, only about half of private, non-profit schools offer them. The Sloan report, based on a poll of academic leaders, indicated that students generally appear to be at least as satisfied with their on-line classes as they are with traditional ones. Private institutions may become more involved with on-line presentations as the cost of instituting such a system decreases. Properly trained staff must also be hired to work with students on-line. These staff members need to understand the content area, and also be highly trained in the use of the computer and Internet. Online education is rapidly increasing, and online doctoral programs have even developed at leading research universities.

History

Early e-learning systems, based on Computer-Based Learning/Training often attempted to replicate autocratic teaching styles whereby the role of the e-learning system was assumed to be for transferring knowledge, as opposed to systems developed later based on Computer Supported Collaborative Learning (CSCL), which encouraged the shared development of knowledge.

As early as 1993, William D. Graziadei described an online computer-delivered lecture, tutorial and assessment project using electronic Mail, two VAX Notes conferences and Gopher/Lynx together with several software programs that allowed students and instructor to create a Virtual Instructional Classroom Environment in Science (VICES) in Research, Education, Service & Teaching (REST). In 1997 Graziadei, W.D., et al., published an article entitled "Building Asynchronous and Synchronous Teaching-Learning Environments: Exploring a Course/Classroom Management System Solution". They described a process at the State University of New York (SUNY) of evaluating products and developing an overall strategy for technology-based course development and management in teaching-learning. The product(s) had to be easy to use and maintain, portable, replicable, scalable, and immediately affordable, and they had to have a high probability of success with long-term cost-effectiveness. Today many technologies can be, and are, used in e-learning, from blogs to collaborative software, ePortfolios, and virtual classrooms. Most eLearning situations use combinations of these techniques.

E-Learning 2.0

The term E-Learning 2.0 is a neologism for CSCL systems that came about during the emergence of Web 2.0 From an E-Learning 2.0 perspective, conventional e-learning systems were based on instructional packets, which were delivered to students using Internet technologies. The role of the student consisted of learning from the readings and preparing assignments. Assignments were evaluated by the teacher. In contrast, the new e-learning places increased emphasis on social learning and use of social software such as blogs, podcasts and virtual worlds such as *Second Life*.

E-Learning 2.0, by contrast to e-learning systems not based on CSCL, assumes that knowledge (as meaning and understanding) is socially constructed. Learning takes place through conversations about content and grounded interaction about problems and actions. Advocates of social learning claim that one of the best ways to learn something is to teach it to others.

However, it should be noted that many early online courses, such as those developed by Murray Turoff andStarr Roxanne Hiltz in the 1970s and 80s at the New Jersey Institute of Technology, courses at the University of Guelph in Canada, the British Open University, and the online distance courses at the University of British Columbia (where Web CT, now incorporated into Blackboard Inc. was first developed), have always made heavy use of online discussion between students. Also, from the start, practitioners such as Harasim (1995) have put heavy emphasis on the use of learning networks for knowledge construction, long before the term e-learning, let alone e-learning 2.0, was even considered.

There is also an increased use of virtual classrooms (online presentations delivered live) as an online learning platform and classroom for a diverse set of education providers such as Minnesota State Colleges and Universities and Sachem School District.

In addition to virtual classroom environments, social networks have become an important part of E-learning 2.0. Social networks have been used to foster online learning communities around subjects as diverse as test preparation and language education. Mobile Assisted Language Learning (MALL) is a term used to describe using handheld computers or cell phones to assist in language learning.

Approaches to e-learning services

E-learning services have evolved since computers were first used in education. There is a trend to move towards blended learning services, where computer-based activities are integrated with practical or classroom-based situations.

Bates and Poole (2003) and the OECD (2005) suggest that different types or forms of e-learning can be considered as a continuum, from no e-learning, i.e. no use of computers and/or the Internet for teaching and learning, through classroom aids, such as making classroom lecture Powerpoint slides available to students through a course web site or learning management system, to laptop programs, where students are required to bring laptops to class and use them as part of a face-to-face class, to hybrid learning, where classroom time is reduced but not eliminated, with more time devoted to online learning, through to fully online learning, which is a form of distance education. This classification is somewhat similar to that of the Sloan Commission reports on the status of e-learning, which refer to web enhanced, web supplemented and web dependent to reflect increasing intensity of technology use. In the Bates and Poole continuum, 'blended learning' can cover classroom aids, laptops and hybrid learning, while 'distributed learning' can incorporate either hybrid or fully online learning.

It can be seen then that e-learning can describe a wide range of applications, and it is often by no means clear even in peer reviewed research publications which form of e-learning is being

discussed. However, Bates and Poole argue that when instructors say they are using e-learning, this most often refers to the use of technology as classroom aids, although over time,

Communication technologies used in E-learning

Communication technologies are generally categorized as asynchronous or synchronous. *Asynchronous* activities use technologies such as blogs and discussion boards. The idea here is that participants may engage in the exchange of ideas or information without the dependency of other participants involvement at the same time. Electronic mail (Email) is also asynchronous in that mail can be sent or received without having both the participants' involvement at the same time.

Synchronous activities involve the exchange of ideas and information with one or more participants during the same period of time. A face to face discussion is an example of synchronous communications. *Synchronous* activities occur with all participants joining in at once, as with an online chat session or a virtual classroom or meeting.

Virtual classrooms and meetings can often use a mix of communication technologies.

In many models, the writing community and the communication channels relate with the E-learning and the M-learning communities. Both the communities provide a general overview of the basic learning models and the activities required for the participants to join the learning sessions across the virtual classroom or even across standard classrooms enabled by technology. Many activities, essential for the learners in these environments, require frequent chat sessions in the form of virtual classrooms and/or blog meetings.

Content issues

Content is a core component of E-learning and includes issues such as pedagogy and learning object re-use.

Pedagogical elements

Pedagogical elements are an attempt to define structures or units of educational material. For example, this could be a lesson, an assignment, a multiple choice question, a quiz, a discussion group or a case study. These units should be format independent, so although it may be in any of the following methods, pedagogical structures would **not** include a textbook, a web page, a video conference or Podcast.

When beginning to create E-Learning content, the pedagogical approaches need to be evaluated. Simple pedagogical approaches make it easy to create content, but lack flexibility, richness and downstream functionality. On the other hand, complex pedagogical approaches can be difficult to set up and slow to develop, though they have the potential to provide more engaging learning experiences for students. Somewhere between these extremes is an ideal pedagogy that allows a particular educator to effectively create educational materials while simultaneously providing the most engaging educational experiences for students.

Pedagogical approaches or perspectives

It is possible to use various pedagogical approaches for eLearning which include:

- **instructional design** – the traditional pedagogy of instruction which is curriculum focused, and is developed by a centralized educating group or a single teacher.

- **social-constructivist** – this pedagogy is particularly well afforded by the use of discussion forums, blogs and on-line collaborative activities. It is a collaborative approach that opens educational content creation to a wider group including the students themselves. The One Laptop Per Child Foundation attempted to use a constructivist approach in its project

- **Laurillard's Conversational Model** is also particularly relevant to eLearning, and Gilly Salmon's Five-Stage Model is a pedagogical approach to the use of discussion boards.

- **Cognitive perspective** focuses on the cognitive processes involved in learning as well as how the brain works.

- **Emotional perspective** focuses on the emotional aspects of learning, like motivation, engagement, fun, etc.

- **Behavioural perspective** focuses on the skills and behavioural outcomes of the learning process. Role-playing and application to on-the-job settings.

- **Contextual perspective** focuses on the environmental and social aspects which can stimulate learning. Interaction with other people, collaborative discovery and the importance of peer support as well as pressure.

Reusability, standards and learning objects

Much effort has been put into the technical reuse of electronically-based teaching materials and in particular creating or re-using *Learning Objects*. These are self contained units that are properly tagged with keywords, or other metadata, and often stored in an XML file format. Creating a course requires putting together a sequence of learning objects. There are both proprietary and open, non-commercial and commercial, peer-reviewed repositories of learning objects such as the Merlot repository.

A common standard format for e-learning content is SCORM whilst other specifications allow for the transporting of "learning objects" (Schools Framework) or categorizing metadata (LOM).

These standards themselves are early in the maturity process with the oldest being 8 years old. They are also relatively vertical specific: SIF is primarily pK-12, LOM is primarily Corp, Military and Higher Ed, and SCORM is primarily Military and Corp with some Higher Ed. PESC- the Post-Secondary Education Standards Council- is also making headway in developing

standards and learning objects for the Higher Ed space, while SIF is beginning to seriously turn towards Instructional and Curriculum learning objects.

In the US pK12 space there are a host of content standards that are critical as well- the NCES data standards are a prime example. Each state government's content standards and achievement benchmarks are critical metadata for linking e-learning objects in that space.

An excellent example of e-learning that relates to knowledge management and reusability is Navy E-Learning, which is available to Active Duty, Retired, or Disable Military members. This on-line tool provides certificate courses to enrich the user in various subjects related to military training and civilian skill sets. The e-learning system not only provides learning objectives, but also evaluates the progress of the student and credit can be earned toward higher learning institutions. This reuse is an excellent example of knowledge retention and the cyclical process of knowledge transfer and use of data and records.

Chapter- 2

Approaches to E-learning Services

Computer-based learning

Computer-based learning, sometimes abbreviated to CBL, refers to the use of computers as a key component of the educational environment. While this can refer to the use of computers in a classroom, the term more broadly refers to a structured environment in which computers are used for teaching purposes.

Cassandra B. Whyte researched about the ever increasing role that computers would play in higher education. This evolution, to include computer-supported collaborative learning, in addtion to data management, has been realized. The type of computers have changed over the years from cumbersome, slow devices taking up much space in the classroom, home, and office to laptops and handheld devices that are more portable in form and size and this minimalization of technology devices will continue.

Computer-supported collaborative learning

Computer-supported collaborative learning (CSCL) is a method of supporting collaborative learning using computers and the Internet. It is related to Computer Supported Cooperative Work (CSCW) and cuts across research in psychology, computer science, and education.

The technology allows individuals who are far apart to collaborate on-line. The use of these tools is increasing, however many teachers are still new to what tools are available on the Internet and how to use them effectively.

About CSCL

CSCL is a method for bringing the benefits of collaborative learning and cooperative learning to users of distance or co-locative learning via networked computers, such as the courses offered via the Internet or in a digital classroom. The purpose of CSCL is to scaffold or support students in learning together effectively. CSCL supports the communication of ideas and information among learners, collaborative accessing of information and documents, and instructor and peer feedback on learning activities. CSCL also supports and facilitates group processes and group dynamics in ways that are not achievable by face-to-face communication (such as having learners label aspects of their communication). CSCL is a way of integrated teaching.

Current Research

Due to the surge of distance learning via the Internet, including courses that employ CSCL, it is important that educators and instructional designers better understand the benefits and limitations of CSCL. Like many educational activities, it is difficult to evaluate the effectiveness and efficiency of CSCL activities. Early efforts focused on suspected detrimental effects of communication filtering of computer mediated communication (CMC) and ignored the potential benefits of CMC. Historically, the lack of evidence that technological innovations have improved learning in formal education highlights the need for evidence of whether, how and when expected improvements in learning take place.

A key characteristic of CSCL research is its diversity in methodology: CSCL researchers apply laboratory experimental methods, quasi-experimental approaches, discourse analyses, or case studies. Qualitative data shows high regard for use of CSCL tools as aides to learning in the classroom.

Means and Mediums

Online Collaboration tools are the means and mediums of working together on the Internet that facilitates collaboration by individuals who may be far apart. The use of collaborative tools is increasing, however many teachers are still new to what tools are available on the Internet and how to use them effectively.

Benefits

If Collaborative learning is the idea of bringing together learners to work and learn in a collaborative manner, then Computer Supported Collaborative Learning (CSCL) tools accomplish this task either synchronously or asynchronously. Online collaborative tools provide a central locale for these types of interactions.

Some specific benefits of the utilization of web-based applications for collaborative learning include:

- Saves time. Students can work either together or independently, either way contributing to the success of their group overall.
- Develops oral and written communication and social interaction skills.
- Allows for interactions with students outside their class, school, city, state and even country.
- Prepares young students for upper grades and the technology tools they will be encountering there.
- Allows for students who are unable to attend school to keep up with their peers.
- Share ideas.
- Increases student motivation.
- Encourages different perspectives views.
- Aids in metacognitive and evaluative thinking skill development.
- Develops higher level, critical-thinking skills thanks to use of problem-solving approaches.
- Encourages student responsibility for learning.
- Establishes a sense of learning community.
- Creates a more positive attitude about learning.
- Promotes innovation in teaching and classroom techniques.
- Enhances self management skills.
- Develops skill building and practice. Common skills which often require a great deal of practice can be developed through these tools, and made less tedious through these collaborative learning activities in and out of class.
- Develops social skills.

Available Tools

A variety of tools are available via the Internet to assist in online collaboration efforts.

Blogs

Blogs are interactive, online journals.

Application in education

Teachers may write a blog for students in their classrooms with links to Internet sites which aide in learning and/or research tasks. Teachers may have students use blogs as learning reflections, story writing, etc. Viewers can leave comments which aide the writer in his/her writing development.

Learning management systems

Learning management system (LMS) or course management systems (CMS) are an online package to help educators create effective online learning communities.

Application in education

Teachers can post discussion topics, questions, homework or resources in the forums, and answer questions or send messages online. Or they can set quizzes for test review. It can provide a secure place for email exchange. A CMS helps to establish a learning community online. For home-bound children, a CMS can provide the learning experience and collaborative opportunities missed in the classroom.

Survey systems

These tools allow the creation and administration of surveys completely online.

Applications in Education

These tools are great for both teachers and students. Surveys can easily be turned into quizzes with multiple choice answering, and open-ended questioning. The survey can render your results for you, and even synthesize and analyze the results into a variety of formats including charts and graphs.

Online Image/Video Sharing

These tools allow for the sharing of image and video files specifically and often allows commentary, dialogue and/or exchanges.

Application in education

Teachers and students can use these tools to discuss and analyze photos, videos, etc. Teachers and students can upload pictures or video from their computer, camera, or cell phone. It's a great place to store and organize photos and videos; however, it is not entirely secure. The students can then actively engage with the image and think about and discuss specific aspects. Specifically in applications such as Flickr, students can organize pictures by tags. As a collaboration project, teachers can encourage students to upload pictures about a topic, for example a world heritage site, and invite users to contribute tags to the images. In applications, such as VoiceThread, students can add voice and written commentary to the overall video, picture or document. The comments are sequenced, so that late-comers can follow the dialogue.

Video-conferencing/chat/file sharing applications

These are various applications which allow students from around the world to engage in synchronous conferencing through live video feeds, video replays, chatting, and/or voice.

Applications in Education

Teachers can create online working spaces for student groups within their classrooms, across classrooms, grade levels, school, states, the nation, and even the world. Students can work collaboratively on group assignments, and keep active communications ongoing with e-pals.

Online Collaborative Work spaces

Various web-based applications which allow groups of students to work together on common documents in various formats either synchronously or asynchronously. Many applications include to-do lists, calendars, and ample storage space. These spaces are not always secure, however.

Application in Education

You can upload various types of documents or spreadsheets, even PowerPoint presentations in many applications and have students work entirely online asynchronously on a product. Partners and groups can be inside the same classroom, or across the country or world from one another.

Online Whiteboards

Various web-based applications which allow students to chat, while writing, drawing, demonstrating, etc. in/on a virtual whiteboard. Often these applications let you save what has been written on the whiteboard as a picture file, and/or print them.

Application in Education

In these types of Web 2.0 tools, students can brainstorm, create graphics together, and engage in peer-to-peer tutoring in skills and concepts such as multiplication or division. These can often be video-taped to show process, and/or saved as an image file and printed for review.

Virtual worlds

Virtual worlds are areas online where students can interact with each other through avatars.

Application in Education

Virtual Worlds, such as Whyville, have great potential in education by providing fun, highly motivating, places for collaboration. In these virtual worlds new functions are constantly being added that provide additional utility to the system. This environment provides ample opportunity for social skills development and writing/reading skill development through a fun, non-intimidating manner.

Mind maps

Mind maps are diagrams used to represent words, ideas, tasks, or other items.

Application in education

Teachers can utilize brainstorming approaches that can generate ideas without regard for a more formal, hierarchical organization system. Notetaking, organizing, connecting, summarizing, revising, and general clarifying of thoughts can be accomplished with this tool.

Teacher's Role

Instructors play a vital role in facilitating online collaborative learning. Researchers indicate that strong instructor support, frequent instructor-student interaction, and superior organizational skills are critical elements of successful online collaborative learning (Ku, Lohr, & Cheng, 2004). According to the Shank study, competencies of online instructors and those planning the use of online collaboration tools in the traditional classroom setting, are as follows:

- Administrative—The primary goal is to assure smooth operations and reduce instructor and learner overload.
- Design—The primary goal is to assure successful learning outcomes.
- Facilitation—The primary goal is to provide social benefits and enhanced learning.
- Evaluation—The primary goal is to assure that learners know how they will be evaluated and help learners meet objectives.
- Technical—The primary goal is to assure that barriers due to technical components are overcome.

Technology-Enhanced Learning

Technology enhanced learning (or **TEL**) refers to the support of any learning activity through technology.

TEL is often used synonymously with E-Learning even though there are significant differences. The main difference between the two expressions is that TEL focuses on the technological support of any pedagogical approach that utilizes technology. However this is rarely presented as including print technology or the developments around libraries, books and journals in the centuries before computers.

A learning activity can be described in terms of the

- learning resources: creation, distribution, access, compilation, consumption of digital content; tools and services
- actions: communication, collaboration, interaction with software tools
- context: time, duration, surrounding people and location
- roles: A learning activity is carried out by various actors in changing roles (e.g. student, teacher, facilitator, learning coach, human resource or education manager).
- learning objective: to support every human in achieving her or his learning goals, respecting individual as well as organizational learning preferences

Learning activities can follow different pedagogical approaches and didactic concepts.The main focus in TEL is on the interplay between these activities and respective technologies. This can range from enabling access to and authoring of a learning resource to elaborate software systems managing (e.g. learning management system, learning content management systems, learning repositories, adaptive learning hypermedia systems, etc.) and managing (human resource management systems; tools for self-directed learning, etc.) the learning process of learners with technical means.

About the definition

The existing definitions for technology enhanced learning spread very broad and change continuously due to the dynamic nature of this evolving research field. Hence, the definition of TEL must be as broad and general as possible in order to capture all aspects:

Technology enhanced learning (TEL) has the goal of providing socio-technical innovations (also improving efficiency and cost effectiveness) for learning practices, regarding individuals and organizations, independent of time, place and pace. The field of TEL therefore describes the support of any learning activity through technology.

TEL in Europe

The EU supports a number of projects in the area of TEL.

There are several Networks of Excellences that (have) specifically contribute(d) to shaping the research area around TEL:

- PROLEARN: ended
- Kaleidoscope: ended
- STELLAR: running

TEL in the United Kingdom

The Teaching and Learning Research Programme is currently in its Technology Enhanced Learning phase. It is currently funding eight large projects in the TEL field across the UK.

Chapter- 3

Technology Issues

Educational technology

Educational technology (also called **learning technology**) is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources." The term educational technology is often associated with, and encompasses, instructional theory and learning theory. While instructional technology covers the processes and systems of learning and instruction, educational technology includes other systems used in the process of developing human capability. Educational Technology includes, but is not limited to, software, hardware, as well as Internet applications and activities. But there is still debate on what these terms mean.

Explanation and meaning

Educational technology is most simply and comfortably defined as an array of tools that might prove helpful in advancing student learning. Educational Technology relies on a broad definition of the word "technology". Technology can refer to material objects of use to humanity, such as machines or hardware, but it can also encompass broader themes, including systems, methods of organization, and techniques. Some modern tools include but are not limited to overhead projectors, laptop computers, and calculators. Newer tools such as "smartphones" and games (both online and offline) are beginning to draw serious attention for their learning potential.

Those who employ educational technologies to explore ideas and communicate meaning are learners or teachers.

Consider the *Handbook of Human Performance Technology*. The word technology for the sister fields of Educational and Human Performance Technology means "applied science." In other words, any valid and reliable process or procedure that is derived from basic research using the "scientific method" is considered a "technology." Educational or Human Performance Technology may be based purely on algorithmic or heuristic processes, but neither necessarily implies physical technology. The word technology comes from the Greek "techne" which means

craft or art. Another word, "technique," with the same origin, also may be used when considering the field Educational Technology. So Educational Technology may be extended to include the techniques of the educator.

A classic example of an Educational Psychology text is Bloom's 1956 book, *Taxonomy of Educational Objectives*. Bloom's Taxonomy is helpful when designing learning activities to keep in mind what is expected of—and what are the learning goals for—learners. However, Bloom's work does not explicitly deal with educational technology *per se* and is more concerned with pedagogical strategies.

According to some, an Educational Technologist is someone who transforms basic educational and psychological research into an evidence-based applied science (or a technology) of learning or instruction. Educational Technologists typically have a graduate degree (Master's, Doctorate, Ph.D., or D.Phil.) in a field related to educational psychology, educational media, experimental psychology, cognitive psychology or, more purely, in the fields of Educational, Instructional or Human Performance Technology or Instructional (Systems) Design. But few of those listed below as theorists would ever use the term "educational technologist" as a term to describe themselves, preferring terms such as "educator". The transformation of educational technology from a cottage industry to a profession is discussed by Shurville, Browne, and Whitaker.

Theories and practices

Three main theoretical schools or philosophical frameworks have been present in the educational technology literature. These are Behaviorism, Cognitivism and Constructivism. Each of these schools of thought are still present in today's literature but have evolved as the Psychology literature has evolved.

Behaviorism

This theoretical framework was developed in the early 20th century with the animal learning experiments of Ivan Pavlov, Edward Thorndike, Edward C. Tolman, Clark L. Hull, B.F. Skinner and many others. Many psychologists used these theories to describe and experiment with human learning. While still very useful this philosophy of learning has lost favor with many educators.

Skinner's Contributions

B.F. Skinner wrote extensively on improvements of teaching based on his functional analysis of Verbal Behavior and wrote "The Technology of Teaching", an attempt to dispel the myths underlying contemporary education as well as promote his system he called programmed instruction. Ogden Lindsley also developed the Celeration learning system similarly based on behavior analysis but quite different from Keller's and Skinner's models.

Cognitivism

Cognitive science has changed how educators view learning. Since the very early beginning of the Cognitive Revolution of the 1960s and 1970s, learning theory has undergone a great deal of change. Much of the empirical framework of Behaviorism was retained even though a new paradigm had begun. Cognitive theories look beyond behavior to explain brain-based learning. Cognitivists consider how human memory works to promote learning.

After memory theories like the Atkinson-Shiffrin memory model and Baddeley's Working memory model were established as a theoretical framework in Cognitive Psychology, new cognitive frameworks of learning began to emerge during the 1970s, 1980s, and 1990s. It is important to note that Computer Science and Information Technology have had a major influence on Cognitive Science theory. The Cognitive concepts of working memory (formerly known as short term memory) and long term memory have been facilitated by research and technology from the field of Computer Science. Another major influence on the field of Cognitive Science is Noam Chomsky. Today researchers are concentrating on topics like Cognitive load and Information Processing Theory.

Constructivism

Constructivism is a learning theory or educational philosophy that many educators began to consider in the 1990s. One of the primary tenets of this philosophy is that learners construct their own meaning from new information, as they interact with reality or others with different perspectives.

Constructivist learning environments require students to utilize their prior knowledge and experiences to formulate new, related, and/or adaptive concepts in learning. Under this framework the role of the teacher becomes that of a facilitator, providing guidance so that learners can construct their own knowledge. Constructivist educators must make sure that the prior learning experiences are appropriate and related to the concepts being taught. Jonassen (1997) suggests "well-structured" learning environments are useful for novice learners and that "ill-structured" environments are only useful for more advanced learners. Educators utilizing technology when teaching with a constructivist perspective should choose technologies that reinforce prior learning perhaps in a problem-solving environment.

Connectivism

Connectivism is "a learning theory for the digital age," and has been developed by George Siemens and Stephen Downes based on their analysis of the limitations of behaviourism, cognitivism and constructivism to explain the effect technology has had on how we live, how we communicate, and how we learn. Donald G. Perrin, Executive Editor of the International Journal of Instructional Technology and Distance Learning says the theory "combines relevant elements of many learning theories, social structures, and technology to create a powerful theoretical construct for learning in the digital age."

Instructional technique and technologies

Problem Based Learning and Inquiry-based learning are active learning educational technologies used to facilitate learning. Technology which includes physical and process applied science can be incorporated into project, problem, inquiry-based learning as they all have a similar educational philosophy. All three are student centered, ideally involving real-world scenarios in which students are actively engaged in critical thinking activities. The process that students are encouraged to employ (as long as it is based on empirical research) is considered to be a technology. Classic examples of technologies used by teachers and Educational Technologists include Bloom's Taxonomy and Instructional Design.

Theorists

This is an area where new thinkers are coming to the forefront everyday. Many of the ideas spread from theorists, researchers, and experts through their blogs. Many of these blogs are recognized by their peers each year through the edublogger awards. Web 2.0 technologies have led to a huge increase in the amount of information available on this topic and the number of educators formally and informally discussing it. Most listed below have been around for more than a decade, however, and few new thinkers mentioned above are listed here.

- Alan November
- Seymour Papert
- Will Richardson
- John Sweller
- Alex Jones
- George Siemens
- David Wiley
- David Wilson

Benefits

Educational technology is intended to improve education over what it would be without technology. Some of the claimed benefits are listed below:

- **Easy-to-access course materials**. Instructors can post the course material or important information on a course website, which means students can study at a time and location they prefer and can obtain the study material very quickly
- **Student motivation**. Computer-based instruction can give instant feedback to students and explain correct answers. Moreover, a computer is patient and non-judgmental, which can give the student motivation to continue learning. According to James Kulik, who studies the effectiveness of computers used for instruction, students usually learn more in less time when receiving computer-based instruction and they like classes more and develop more positive attitudes toward computers in computer-based classes. The American educator, Cassandra B. Whyte, researched and reported about the importance of locus of control and successful academic performance and by the late 1980s, she wrote of how important computer usage and information technology would become in the higher education experience of the future.
- **Wide participation**. Learning material can be used for long distance learning and are accessible to a wider audience

- **Improved student writing**. It is convenient for students to edit their written work on word processors, which can, in turn, improve the quality of their writing. According to some studies, the students are better at critiquing and editing written work that is exchanged over a computer network with students they know
- **Subjects made easier to learn**. Many different types of educational software are designed and developed to help children or teenagers to learn specific subjects. Examples include pre-school software, computer simulators, and graphics software
- A structure that is more amenable to measurement and improvement of outcomes. With proper structuring it can become easier to monitor and maintain student work while also quickly gauging modifications to the instruction necessary to enhance student learning.

Criticism

Although technology in the classroom does have many benefits, there are clear drawbacks as well. Lack of proper training, limited access to sufficient quantities of a technology, and the extra time required for many implementations of technology are just a few of the reasons that technology is often not used extensively in the classroom.

Similar to learning a new task or trade, special training is vital to ensuring the effective integration of classroom technology. Since technology is not the end goal of education, but rather a means by which it can be accomplished, educators must have a good grasp of the technology being used and its advantages over more traditional methods. If there is a lack in either of these areas, technology will be seen as a hindrance and not a benefit to the goals of teaching.

Another difficulty is introduced when access to a sufficient quantity of a resource is limited. This is often seen when the quantity of computers or digital cameras for classroom use is not enough to meet the needs of an entire classroom. It also occurs in less noticed forms such as limited access for technology exploration because of the high cost of technology and the fear of damages. In other cases, the inconvenience of resource placement is a hindrance, such as having to transport a classroom to a computer lab instead of having in-classroom computer access by means of technology such as laptop carts.

Technology implementation can also be time consuming. There may be an initial setup or training time cost inherent in the use of certain technologies. Even with these tasks accomplished, technology failure may occur during the activity and as a result teachers must have an alternative lesson ready. Another major issue arises because of the evolving nature of technology. New resources have to be designed and distributed whenever the technological platform has been changed. Finding quality materials to support classroom objectives after such changes is often difficult even after they exist in sufficient quantity and teachers must design these resources on their own.

Educational technology and the humanities

Research from the Alberta Initiative for School Improvement (AISI) indicates that inquiry and project-based approaches, combined with a focus on curriculum, effectively supports the infusion of educational technologies into the learning and teaching process.

Technology in the classroom

There are many kinds of computer and non-computer technologies currently in use in traditional classrooms. Among these are:

- **Computer in the classroom:** Having a computer in the classroom is an asset to any teacher. With a computer in the classroom, teachers are able to demonstrate a new lesson, present new material, illustrate how to use new programs, and show new websites.

- **Class website:** What better way to display your student's work, than to create a web page designed just for your class. Once a web page is designed, teachers can post homework assignments, student work, famous quotes, trivia games, and so much more. In current day society, children know how to use the computer and navigate their way through a website, so why not give them one where they can be a published author. Just be careful as most districts maintain strong policies to manage official websites for a school or classroom.

- **Wireless classroom microphones:** Noisy classrooms are a daily occurrence, and with the help of microphones, students are able to hear their teachers clearer. Children learn better when they hear the teacher clearly. The benefit for teachers is that they no longer lose their voices at the end of the day.

- **Mobile devices:** Mobile devices such as clickers or smartphone can be used to enhance the experience in the classroom by providing the possibility for professors to get feedback.

- **SmartBoards:** An interactive whiteboard that provides touch control of computer applications. These enhance the experience in the classroom by showing anything that can be on a computer screen. This not only aids in visual learning, but it is interactive so the students can draw, write, or manipulate images on the SmartBoard.

- **Online media:** Streamed video websites can be utilized to enhance a classroom lesson (e.g. United Streaming, Teacher Tube, etc.)

There are many other tools being utilized depending on the local school board and fund availability. These may include: digital cameras, video cameras, interactive whiteboard tools, document cameras, or LCD projectors.

Communication technologies used in E-learning

Communication technologies are generally categorized as asynchronous or synchronous. *Asynchronous* activities use technologies such as blogs and discussion boards. The idea here is that participants may engage in the exchange of ideas or information without the dependency of other participants involvement at the same time. Electronic mail (Email) is also asynchronous in that mail can be sent or received without having both the participants' involvement at the same time.

Synchronous activities involve the exchange of ideas and information with one or more participants during the same period of time. A face to face discussion is an example of synchronous communications. *Synchronous* activities occur with all participants joining in at once, as with an online chat session or a virtual classroom or meeting.

Virtual classrooms and meetings can often use a mix of communication technologies.

In many models, the writing community and the communication channels relate with the E-learning and the M-learning communities. Both the communities provide a general overview of the basic learning models and the activities required for the participants to join the learning sessions across the virtual classroom or even across standard classrooms enabled by technology. Many activities, essential for the learners in these environments, require frequent chat sessions in the form of virtual classrooms and/or blog meetings.

Learning management system

A **learning management system** (commonly abbreviated as **LMS**) is a software application for the administration, documentation, tracking, and reporting of training programs, classroom and online events, e-learning programs, and training content. As described in (Ellis 2009) a robust LMS should be able to do the following:

- centralize and automate administration
- use self-service and self-guided services
- assemble and deliver learning content rapidly
- consolidate training initiatives on a scalable web-based platform
- support portability and standards
- personalize content and enable knowledge reuse.

LMSs range from systems for managing training and educational records, to software for distributing courses over the Internet with features for online collaboration. Corporate training use LMSs to automate record-keeping and employee registration. Student self-service (e.g., self-registration on instructor-led training), training workflow (e.g., user notification, manager approval, wait-list management), the provision of on-line learning (e.g., Computer-Based Training, read & understand), on-line assessment, management of continuous professional education (CPE), collaborative learning (e.g., application sharing, discussion threads), and training resource management (e.g., instructors, facilities, equipment), are dimensions to Learning Management Systems.

Some LMSs are Web-based to facilitate access to learning content and administration. LMSs are used by regulated industries (e.g. financial services and biopharma) for compliance training. It is also used by educational institutions to enhance and support classroom teaching and offering courses to a larger population of learners across the globe.

Some LMS providers include "performance management systems", which encompass employee appraisals, competency management, skills-gap analysis, succession planning, and multi-rater assessments (i.e., 360 degree reviews).

For the commercial market, some Learning and Performance Management Systems include recruitment and reward functionality.

Characteristics

LMSs cater to educational, administrative, and deployment requirements. While an LMS for corporate learning, for example, may share many characteristics with a VLE, or virtual learning environment, used by educational institutions, they each meet unique needs. The virtual learning environment used by universities and colleges allow instructors to manage their courses and exchange information with students for a course that in most cases will last several weeks and will meet several times during those weeks. In the corporate setting a course may be much shorter in length, completed in a single instructor-led event or online session.

The characteristics shared by both types of LMSs include:

- Manage users, roles, courses, instructors, facilities, and generate reports
- Course calendar
- Learning Path
- Student messaging and notifications
- Assessment and testing handling before and after testing
- Display scores and transcripts
- Grading of coursework and roster processing, including waitlisting
- Web-based or blended course delivery

Characteristics more specific to corporate learning, which sometimes includes franchisees or other business partners, include:

- Autoenrollment (enrolling Students in courses when required according to predefined criteria, such as job title or work location)
- Manager enrollment and approval
- Boolean definitions for prerequisites or equivalencies
- Integration with performance tracking and management systems
- Planning tools to identify skill gaps at departmental and individual level
- Curriculum, required and elective training requirements at an individual and organizational level
- Grouping students according to demographic units (geographic region, product line, business size, etc.)
- Assign corporate and partner employees to more than one job title at more than one demographic unit

Technical aspects

Most LMSs are web-based, built using a variety of development platforms, like Java/J2EE, Microsoft .NET or PHP. They usually employ the use of a database like Mysql, Microsoft Sql Server or Oracle as back-end. Although most of the systems are commercially developed and have commercial software licenses there are several systems that have an open-source license.

Learning content management system (LCMS)

A learning content management system (LCMS) is a related technology to the learning management system, in that it is focused on the development, management and publishing of the content that will typically be delivered via an LMS. An LCMS is a multi-user environment where developers may create, store, **reuse**, manage, and deliver digital learning content from a central object repository. The LMS cannot create and manipulate courses; it cannot reuse the content of one course to build another. The LCMS, however, can create, manage and deliver not only training modules but also manage and edit all the individual pieces that make up a catalog of training. LCMS applications allow users to create, import, manage, search for and reuse small units or "chunks" of digital learning content and assets, commonly referred to as learning objects. These assets may include media files developed in other authoring tools, assessment items, simulations, text, graphics or any other object that makes up the content within the course being created. An LCMS manages the process of creating, editing, storing and delivering e-learning content, ILT materials and other training support deliverables such as job aids.

A comparison between Learning Management Systems and Learning Content Management Systems

Some systems have tools to deliver and manage instructor-led synchronous and asynchronous online training based on learning object methodology. These systems are called Learning Content Management Systems or LCMSs. LCMSs provide tools for authoring and reusing or re-purposing content (mutated learning objects) MLO as well as virtual spaces for student interaction (such as discussion forums, live chat rooms and live web-conferences). Despite this distinction, the term LMS is often used to refer to both an LMS and an LCMS, although the LCMS is a further development of the LMS. Due to this conformity issue, the acronym CLCIMS (*Computer Learning Content Information Management System*) is now widely used to create a uniform phonetic way of referencing any learning system software based on advanced learning technology methodology.

In essence, an LMS is software for planning, delivering, and managing learning events within an organization, including online, virtual classroom, and instructor-led courses. For example, an LMS can simplify global certification efforts, enable entities to align learning initiatives with strategic goals, and provide a means of enterprise-level skills management. The focus of an LMS is to manage students, keeping track of their progress and performance across all types of training activities. It performs administrative tasks, such as reporting to instructors, HR and other ERP systems but isn’t used to create course content.

By contrast, an LCMS is software for managing learning content across an organization's various training development areas. It provides developers, authors, instructional designers, and subject matter experts the means to create and re-use e-learning content and reduce duplicated development efforts. In the remote AICC hosting approach, an LCMS may host the content in a central repository and allow multiple LMSs to access it.

Primary business problems an LCMS solves are

- centralized management of an organization's learning content for efficient searching and retrieval,
- productivity gains around rapid and condensed development timelines,
- productivity gains around assembly, maintenance and publishing / branding / delivery of learning content.

Rather than developing entire courses and adapting them to multiple audiences, an LCMS provides the ability for single course instances to be modified and republished for various audiences maintaining versions and history. The objects stored in the centralized repository can be made available to course developers and content experts throughout an organization for potential reuse and repurpose. This eliminates duplicate development efforts and allows for the rapid assembly of customized content.

To look at this another way, an LMS is learner–centric. It focuses on e-learning process management and content delivery. In essence, an LMS is software for planning, delivering and managing learning events within an organization, including online, virtual classroom, and instructor-led courses. For example, an LMS can simplify global certification efforts, enable entities to align learning initiatives with strategic goals and provide a means for enterprise-level skills management. The focus of an LMS is to manage students, keeping track of their progress and performance across all types of training activities. It performs administrative tasks, such as reporting to instructors, HR and other ERP systems but it isn’t used to create course content.

An LCMS is content–centric. Here, the focus is on the authoring and management of e-learning reusable content.

By contrast, LCMS solutions are ideally suited to create content-centric learning strategies, supporting multiple methods for gathering and organizing content, leveraging content for multiple purposes, and operation for mission critical purposes. LCMS technology can either be used in tandem with an LMS, or as a standalone application for learning initiatives that require rapid development and distribution of learning content.

Rather than developing entire courses and adapting them to multiple audiences, an LCMS is designed for managing learning content across an organization's various training development areas. It provides developers, authors, instructional designers, and subject matter experts the means to create and re-use e-learning content and reduce duplicated development efforts. An LCMS provides the ability for single course instances to be modified and republished for various audiences maintaining versions and history. The objects stored in the centralized repository can

be made available to course developers and content experts throughout an organization for potential reuse and repurpose. This allows for the rapid assembly of customized content.

In addition, Brandon Hall believes that: “when LCMS technology is appropriately applied and matched to an orchestrated e-learning strategy, with a complete instructional design plan for designing and using learning objects, great efficiencies can and will be achieved, such as: • The ability to make instantaneous, company-wide changes to critical learning content • Rapid and productive content development efforts • Seamless collaboration among subject matter experts and course designers • The ability to create multiple, derivative versions of content applicable to different audiences from senior management to line-level workers • Access to find and reuse learning content, ‘just-in-time’ and ‘just enough’ • Ultimate reusability of content by making it available through a wide array of output types such as structured e-learning courses, CD-ROM courses, learning material available from a Palm device or PocketPC, print-based learning for use in classroom settings, and so on.”

Learning management industry

In the relatively new LMS market, commercial vendors for corporate and education applications range from new entrants to those that entered the market in the nineties. In addition to commercial packages, many open source solutions are available.

As reported in (Bersin et al. 2009), LMSs represent an $860 million market, made up of more than 60 different providers. The six largest LMS product companies constitute approximately 50% of the market. In addition to the remaining smaller LMS product vendors, training outsourcing firms, enterprise resource planning vendors, and consulting firms all compete for part of the learning management market. Approximately 40 percent of U.S. training organizations reported that they have an LMS installed, a figure that has not changed significantly over the past two years. The small business market offers the greatest opportunity for growth, as only 36 percent of these companies are using an LMS. Many of these businesses would like a low-cost, easy-to-use, easy-to-maintain system – but, as yet, they are not willing to make the commitment. An LMS is still a nontrivial investment in money and resources.

According to a 2009 report by American Society for Training and Development(ASTD) 91 percent of ASTD respondents are using LMS's in their organizations, with more than half (55 percent) purchasing rather than building (11.7 percent) their systems, and one-fifth of respondents (21.3 percent) opting to go with a hosted platform. And whether built or bought, the majority of respondents are satisfied with their current LMS, with 22.2 percent very satisfied, 31.1 percent satisfied, and 25.6 percent somewhat satisfied. Still, some 13.3 said they were unsatisfied, and 8.8 said they were very unsatisfied.

Channel learning is under-served. For many buyers channel learning is not their number one priority, according to a survey by Trainingindustry.com (Expertus & TrainingOutsourcing 2006). Often there is a disconnect when the HR department oversees training and development initiatives, where the focus is consolidating LMS systems inside traditional corporate boundaries. Software technology companies are at the front end of this curve, placing higher priority on channel training.

Today the biggest trend in the LMS market is for these systems to be integrated with "Talent Management" software systems. The largest LMS providers have performance management, collaborative learning, content management, succession management, and other talent management modules to their systems. Bersin research shows that in 2009 more than 70% of large companies have an LMS already and almost 1/3 of these companies are considering replacing or upgrading these systems with integrated talent management systems (Levensaler & Laurano 2009).

Most buyers of LMSs utilize an authoring tool to create their e-learning content, which is then hosted on an LMS. In many cases LMSs include a primitive authoring tool for basic content manipulation. For advanced content creation buyers must choose an authoring software that integrates with their LMS in order for their content to be hosted. There are authoring tools on the market, which meet AICC and SCORM standards and therefore content created in tools such as these can be hosted on an AICC or SCORM certified LMS. By May 2010, ADL had validated 301 SCORM-certified products while 329 products were compliant.

Computer aided assessment

Computer aided assessment is a term that covers all forms of assessment, whether Summative (i.e. tests that will contribute to formal qualifications) or Formative (i.e. tests that promote learning but are not part of a course's marking), delivered with the help of computers. This covers both assessments delivered on computer, either online or on a local network, and those that are marked with the aid of computers, such as those using Optical Mark Reading (OMR). There are number of open source online tools to handle exams conducted on OMR sheets.

Computer Aided Assessment can be viewed in a few different ways. Technically, assignments that are written on a computer and researched online are computer aided assessments. One of the most common forms of computer aided assessment (in terms of eLearning) is online quizzes or exams. These can be implemented online, and also marked by the computer by putting the answers in. Many Content Management Systems will have easy to setup and use systems for online exams.

It is also envisaged that computer-based formative assessment, in particular, will play an increasingly important role in learning, with the increased use of banks of question items for the construction and delivery of dynamic, on-demand assessments. This can be witnessed by current pioneering projects such as the SQA's SOLAR Project.

Chapter- 4

Virtual Learning Environment and Virtual World Language Learning

Virtual learning environment

A **virtual learning environment (VLE)** is a system designed to support teaching and learning in an educational setting, as distinct from a Managed Learning Environment (MLE), where the focus is on management.

Overview

A VLE will normally work over the Internet and provide a collection of tools such as those for assessment (particularly of types that can be marked automatically, such as multiple choice), communication, uploading of content, return of students' work, peer assessment, administration of student groups, collecting and organizing student grades, questionnaires, tracking tools, etc. New features in these systems include blogs, RSS and 3D virtual learning spaces.

While originally created for distance education, VLEs are now most often used to supplement traditional face to face classroom activities, commonly known as Blended Learning. These systems usually run on servers, to serve the course to students Multimedia and/or web pages.

In 'Virtually There', a book and DVD pack distributed freely to schools by the Yorkshire and Humber Grid for Learning Foundation (YHGfL), Professor Stephen Heppell writes in the foreword:

"*Learning is breaking out of the narrow boxes that it was trapped in during the 20th century; teachers' professionalism, reflection and ingenuity are leading learning to places that genuinely excite this new generation of connected young school students — and their teachers too. VLEs are helping to make sure that their learning is not confined to a particular building, or restricted to any single location or moment.*"

Similar terms

A VLE is a computer program that facilitates computerized learning or e-learning. Such e-learning systems are sometimes also called Learning Management System (LMS), Content Management System (CMS), Learning Content Management System (LCMS), Managed Learning Environment (MLE), Learning Support System (LSS), Online Learning Centre (OLC), OpenCourseWare (OCW), or Learning Platform (LP); it is education via computer-mediated communication (CMC) or Online Education.

A more correct term may be a virtual environment for learning, rather than virtual learning environment. This removes any ambiguities and identifies that it is the environment which is virtual and not the learning. The term virtual may also contribute to confusion, suggesting that the learning is not real or authentic.

In the United States, CMS and LMS are the more common terms, however LMS is more frequently associated with software for managing corporate training programs rather than courses in traditional education institutions.

In the United Kingdom and many European countries, the terms VLE and MLE are favored; however, it is important to realize that these are two very different things. A VLE can be considered a subsystem of an MLE, whereas MLE refers to the wider infrastructure of information systems in an organization that support and enable electronic learning on a wider scale. In fact a rather pedantic reading of the term MLE could be extended to encompass the physical environment in which learning takes place (i.e. a school). Also the use of VLE avoids confusion with the use of LMS to mean "Library Management System" (which is more commonly referred to as Integrated Library System, or ILS, in the United States).

Becta, in the UK, have coined the term *learning platform* to cover both MLE and VLE as used in the schools sector. 'The term learning platform describes a broad range of ICT systems used to deliver and support learning. Through a learning platform, hardware, software and supporting services are brought together to enable more effective ways of working within and outside the classroom. At the heart of any learning platform is the concept of a personalized online learning space for the pupil. This space should offer teachers and pupils access to stored work, e-learning resources, communication and collaboration with peers, and the facility to track progress.'

Facilities

A VLE should make it possible for a course designer to present to students, through a single, consistent, and intuitive interface, all the components required for a course of education or training. Although logically it is not a requirement, in practice VLEs always make extensive use of computers and the Internet. A VLE should implement all the following elements:

- The syllabus for the course
- Administrative information including the location of sessions, details of pre-requisites and co-requisites, credit information, and how to get help

- A notice board for up-to-date course information
- Student registration and tracking facilities, if necessary with payment options
- Basic teaching materials. These may be the complete content of the course, if the VLE is being used in a distance learning context, or copies of visual aids used in lectures or other classes where it is being used to support a campus-based course.
- Additional resources, including reading materials, and links to outside resources in libraries and on the Internet.
- Self-assessment quizzes which can be scored automatically
- Formal assessment procedures
- Electronic communication support including e-mail, threaded discussions and a chat room, with or without a moderator
- Differential access rights for instructors and students
- Production of documentation and statistics on the course in the format required for institutional administration and quality control
- All these facilities should be capable of being hyperlinked together
- Easy authoring tools for creating the necessary documents including the insertion of hyperlinks - though it is acceptable (arguably, preferable) for the VLE to be designed allowing standard word processors or other office software to be used for authoring.

In addition, the VLE should be capable of supporting numerous courses, so that students and instructors in a given institution (and, indeed, across institutions) experience a consistent interface when moving from one course to another.

Popularity

Open University Support System

Universities and other institutions of higher and further education are increasingly turning to VLEs in order to:

- Economize on the time of teaching staff, especially when they are also involved in research and administration. The extent of the economy over traditional "talk-and-chalk" teaching is not yet clear, but for instructors without web development expertise, using a VLE absorbs less time and produces a more professional result.
- Provide a service for students who increasingly look to the internet as the natural medium for finding information and resources.
- Ensure that quality control requirements are met by providing a standard vehicle for collecting the required information
- Facilitate the integration of distance and campus-based learning or of learning on different campuses.

For example, accredited institutions such as Chapman College University, Touro University, and Adams State College offer online, on-demand teacher training courses for educators to earn graduate credit and/or masters degrees. In the UK schools are being encouraged to make use of learning platforms. The DCSF in the UK government has published an eStrategy outlining priorities that include every learner in schools having access to an online learning space and e-portfolio.

Transferring course content

Most VLEs support Shareable Content Object Reference Model (SCORM) as a standard way to upload, launch and track courses. There are no commonly used standards that define how the learner's performance within a course should be transferred from one VLE to another.

Some institutions have attempted to combat this problem by agreeing to share common platforms. Use of open source VLEs such as Moodle (moodle is also referred to as a CMS or Course Management System) have more recently enabled institutions to share content more easily. For the schools sector in the UK the DCSF via Becta has defined a learning platform "conformance framework" to encourage interoperability.

Systems available

For those wishing to deliver elearning there are many free open source and proprietary VLEs available for use. On-demand elearning services are also a popular choice because they can be deployed in minutes and do not require instructors and institutions to run their own servers.

Many VLEs are placed on a web server. In a typical VLE there are one or more programs or languages that provides the user (Teacher-Student) interface, and which interacts with a database. For example, a VLE might use PHP as its web language/program, with MySQL as a database.

VLEs are increasingly found in new niches. These include new emerging technologies, as well as specialized markets. A VLE can be deployed on a USB drive as a child, which synchronizes from time to time with its web-based parent. VLEs can be used for training or in something as specialized as to meet ISO 9000 certification requirements.

Virtual world learning environments

Emerging technologies include Sloodle, a merge of Second Life, Moodle, i.e. integrating virtual worlds and course management. This early development approach hints at new options for enabling learning in a social, immersive, and interactive way. Another 3D virtual learning environment called Edusim brings a lessons driven 3D virtual environment to the classroom interactive whiteboard surface allowing the direct manipulation of 3D virtual objects. Umgumbo is an immersive 3D VLE set in a Newtonian simulation of the solar system. Still in development, Umgumbo will allow collaborative and interactive learning within personalized 3D spaces, including educational gaming, and is delivered from a single external website.

List of some virtual learning environments

Learning management systems

- Claroline
- JoomlaLMS - a LMS based on Joomla platform
- LAMS - the Learning Activity Management System
- SharePointLMS - a LMS based on MS SharePoint
- ITWorx_CLG

Course management systems

- CCNet
- Coggno - e-learning software platform and courseware creation toolkit

Free software and open source

- Chamilo
- Claroline
- Dokeos
- eFront
- ILIAS
- Moodle
- Sakai

Virtual learning environment

- Moodle - An open source (free) modular php virtual learning sofware
- Blackboard - A family of virtual learning software

- CyberExtension - Virtual Managed Learning Environment
- FirstClass - Messaging and communications solution
- Heritage Key – Virtual historical environments, such as Tutankhamun's tomb.
- it's Learning - Norwegian Closed Source System (written in ASP.NET)
- Mingoville - Introduction to the English language. Age 8 to 12 (Virtual World and Language games)
- Saba Centra - Part of a Human Capital Development System
- SpicyNodes - Create and share radial maps (related to concept maps and mind maps)
- WebCT - (Now a part of Blackboard) Software applications designed to enhance teaching and learning
- WebTrain - Virtual live classes, enrollment, attendance, attention monitoring.

Other descriptions

- Apex Learning - K-12 online course service and AP test study
- ATutor - LCMS
- Dokeos - elearning and course management web application
- eCollege - comprehensive eLearning solution
- Pass-port - a commercial ePortfolio and assessment system that includes a course management component
- Spiral Universe - student information system
- Yacapaca - free assessment platform with large repository of User-generated content

Virtual world language learning

Language learning is the most widespread type of education in virtual worlds, with many universities, mainstream language institutes and private language schools using 3D virtual environments to support language learning.

History

2005 saw the first large-scale language school, Languagelab.com, open its doors in a virtual world, projects to use virtual worlds such as Active Worlds preceded it.

Many universities (such as Monash University) and mainstream language institutes (such as British Council, Confucius Institute, Instituto Cervantes and Goethe Institut) have islands in Adult Second Life and Teen Second Life specifically for language learning.

Professional and research organizations, such as EUROCALL and CALICO also support virtual world language learning through their activities in Second Life.

Augmented Reality offers a merging of virtual worlds, real life and mobile learning and it is being explored by language educators as a future path for virtual world language education.

Virtual Worlds, 3D Online Environments, and Technological Progress

Both, 3D virtual worlds (such as Second Life and Teen Second Life) and 3D virtual environments (such as Hangout.net) can be used for 3D online language learning. Almost all such language learning projects make use of general virtual worlds that are intended for social networking (rather than for language education). However, there are more recent examples of creating virtual worlds specifically for language education.

Since 2005 Second Life has been the main focus of language education using virtual worlds. This has been largely due to the flexibility offered by Second Life, especially with the opportunity to own land and build educational environments in-world. However, other virtual worlds and 3D online spaces have been used as language learning tools. Twinity replicates the real life city of Berlin (other cities such as Singapore and London to follow) and offers language learners virtual locations with specific languages being spoken. Some islands in Second Life also have language or culture specific communities that may allow language learners easy ways to practice a foreign language. There.com also offers language learning opportunities

Browser-based 3D environments such as ExitReality and 3DXplorer offer 3D spaces for social learning or, in the case of Google Street View and Google Earth immersive learning.

There are virtual worlds, such as Zon and Wiz World that have been specifically designed for language learning and may be considered to be SIEs (Synthetic Immersive Environments).

Open Source 3D platforms for educators, such as the ReactionGrid under OpenSim, in conjunction with the emerging cross-platform and open source format (OFF.TWG) of the Open File Formats Technology Working Group point to the future of a "Create Once, Experience Everywhere" Education Grid strategy.

Grid Computing usage for educators is now being presented at the Super Computer Conference SC09. The SC09 Education Program portion of the annual SC Conference 2009 focuses on engaging educators and students across the K-20 spectrum in learning about the latest technologies and applications for advancing scientific discovery. The educators are supported in their endeavors to integrate emerging technologies and methodologies into the preparation of the future workforce.

Pedagogies/Andragogies and Activities in Virtual Worlds

Two basic target use cases and according learning curves/processes can be distinguished: Andragogy (Heutagogy) for adult grids, Pedagogy for teen/child grids.

As virtual worlds offer social and immersive experiences, the main pedagogical/andragogical (heutagogy) focuses have been with constructivist educational approaches. Task-based language learning has been commonly applied to virtual world language education. Dogme methods that draw on the ability to stimulate conversation and communication for language emergence have also been used to guide language learning activities.

Constructivist approaches

3D virtual worlds are often used for constructivist learning because of the opportunities for learners to explore, collaborate and be immersed within an environment of their choice. Some virtual worlds allow users to build objects and to change the appearance of their avatar and of their surroundings.. Constructivist approaches such as task-based learning and Dogme are applied to virtual world language learning because of the scope for learners to socially co-construct knowledge, in spheres of particular relevance to the learner.

Task-based language learning

Task-based language learning (TBL) focuses on the use of authentic language and encourages students to do real life tasks using the language being learned. Tasks can be highly transactional, where the student is carrying out everyday tasks such as visiting the doctor at the Chinese island of Monash University (in Second Life). Incidental knowledge (about the medical system in China) can also be gained through such immersive TBL. Other tasks may focus on more interactional language, such as ones that involve more social activities or interviews within a virtual world.

Dogme language teaching

The term Dogme 2.0 refers to the application of Dogme principles to teaching and learning languages with web 2.0 tools, including virtual worlds. Dogme has been presented as especially relevant to virtual world language learning because of the social, immersive and creative experiences offered by virtual worlds. These experiences offer opportunities for the language learning to focus on what is relevant to the learner and to stimulate language learning through conversations (either within or outside of the virtual world).

Six Learnings Framework

The “Six Learnings Framework” is a pedagogical outline developed for virtual world education in general. It sets out 6 possible ways to view an educational activity.

- **Exploring**: learners explore a virtual world’s locations and communities as fieldwork for class.
- **Collaborating**: learners work together within a virtual world on collaborative tasks.
- **Being**: learners explore themselves and their identity through their presence in a virtual world, such as through role play.
- **Building**: learners construct objects within a virtual world.

- **Championing**: learners promote real life causes through activities and presentations in a virtual world.
- **Expressing**: learners represent activities within a virtual world to the outside world, through blogs, podcasts, presentations and videos.

Approaches to Language Education in Virtual Worlds

Almost all virtual world educational projects envisage a blended learning approach whereby the language learners are exposed to a 3D virtual environment for a specific activity or time period. Such approaches combine the use of virtual worlds with other online and offline tools, such as 2D virtual learning environments (eg Moodle) or physical classrooms. Other virtual world based language learning is intended to offer a complete language learning environment through a virtual world.

Virtual worlds such as Second Life are used for the immersive, collaborative and game-like opportunities they offer language learners. As such, virtual world language learning can be considered to offer distinct (although combinable) learning experiences

- **Immersive**: Immersive experiences draw on the ability to be surrounded by a certain (real or fictitious) environment that can stimulate language learning.
- **Social**: Almost all 3D virtual spaces are inherently social environments where language learners can meet others, either to informally practice a language or to participate in more formal classes.
- **Creative**: A lesser-developed approach to language learning in virtual worlds is that of constructing objects as part of a language learning activity. There is currently little documentation of such activities.

Owning and Using Land in Virtual Worlds

Most language educators own or rent land in a virtual world, such as Second Life, to facilitate specific educational tasks. This approach offers considerable control over who is allowed to have access to the venue and the visitor permissions.

Holodecks

Holodecks are used in Second Life to offer certain environments while saving space and prims (building units in Second Life). Holodecks are frequently used in language education in Second Life to create specific locations for lessons or learning experiences. Holodecks can be used to encourage students to describe a certain scene or to even build a scene. Holodecks are also used for role plays.

Language Villages

The Language Village concept has been replicated within virtual worlds to create a language immersion environment for language learners in their own country.. Monash University has an island in Second Life that is specifically designed to immerse students in aspects of life in China.

Building and Object Creation

Land ownership is usually necessary if lessons are to include building activities. Although there may be opportunities to use public sandboxes, learners may prefer to exhibit their creations more permanently on owned/rented land.

Public Spaces

Language learning can also take place in public spaces within virtual worlds (such as the Plaza Real in Barcelona). This offers greater flexibility with locations and students can choose the locations themselves, which enables a more constructivist approach.

Virtual Tourism

The wide variety of replica places (such as Barcelona, Berlin, London or Paris) in Second Life offers opportunities for language learning through virtual tourism.

WebQuests

Virtual world WebQuests (also referred to as SurReal Quests) combine the concept of a 2D WebQuests with the immersive and social experiences of 3D virtual worlds. Learners develop texts, audios or podcasts based on their research, part of which is within a virtual world.

Use of Voice

Voice (in-world VOIP) is a relatively recent addition to language learning in virtual worlds. Initial projects using Active Worlds focused on text-chat communication and Second Life only introduced voice capabilities in 2007, prior to this independent VoIP systems were used. Second Life's internal voice system has the added ability to reproduce the effect of distance on voice loudness – so that there is an auditive sense of space amongst users.

Other virtual worlds such as Twinity and There also offer internal voice systems. Browser-based 3D virtual environments tend to only offer text-chat communication, although this seems likely to become more widespread.

Beyond Virtual Worlds

Virtual World Language Learning is a rapidly expanding field and it converges with other closely related areas, such as the use of MMOGs, SIEs and AR.

Massively Multiplayer Online Games (MMOGs)

MMOGs (Massively Multiplayer Online Games) are also used to support language learning although there is limited documentation of this area.

Synthetic Immersive Environments (SIEs)

SIEs are engineered 3D virtual spaces that integrate online gaming aspects. They are specifically designed for educational purposes and offer learners a collaborative and constructionist environment. They also allow the creators/designers to focus on specific skills and pedagogical objectives. Croquelandia is an example of an SIE by the University of Minnesota for Spanish Learning.

Augmented Reality Language Learning (ARLL)

The convergence between virtual worlds and real life are offering new opportunities for language education and Augmented Reality is gaining interest for language learning, especially for m-learning (Mobile Assisted Language Learning).

Chapter- 5

Benchmarking e-learning

Benchmarking is a management tool that has been applied in many areas of business but it is only in 2005-06 that there has been immense growth in its application specifically to university use of educational technology, initially in New Zealand (Marshall, 2005), then in Europe including the UK under the auspices of the Higher Education Academy and most recently spreading to the US. **Benchmarking e-learning** is now seen in the UK as a key enabler of change in universities - some 40 universities and university-level colleges, around one quarter of all relevant UK institutions, are now starting work on this, with a further 12 having recently completed a pilot exercise.

It is possible to trace some early work on benchmarking e-learning in universities back to 1996 - on dimensions of virtuality in virtual universities - but the first work under the name of benchmarking appears to have been in the 1999-2002 era on the BENVIC project and some specific benchmarking activities in English colleges.

History

In addition to the above remarks, for a more general history of e-learning including key dates of benchmarking e-learning events see the History of virtual learning environments.

ACODE

ACODE is the eponymously named benchmarking scheme under development by the Australasian Council on Open, Distance and E-Learning.

Development of this started in 2004 as a pilot project. There is a project page with a useful history and several key documents. The scheme is now available in draft form while it awaits final external peer review.

It is a criterion-based system where criteria (divided into eight main benchmark areas) are scored on a 1-5 scale with the help of scoring statements. It takes a relatively wide view of e-learning,

ensuring linkage with general learning and teaching, with IT and with staff development processes. The use of the word "alignment" in several criterion scoring statements suggests that it has been affected by the MIT90s approach described elsewhere here.

Other information

- There are ACODE press releases of 18–19 May 2006 and 16–17 November 2005.
- A potential ACODE scheme is mentioned in a presentation by Paul Bacsich in November 2005 at the University of Sydney, significant because Bacsich is a benchmarking analyst also cited in one of the ACODE press releases.
- An ACODE statement of January 2006 notes that in "December 2005: Dr Stephen Marshall (Victoria University of Wellington) surveyed members on how well supported students are with regard to IT support and access to helpdesk". Analysis of his institutional affiliation and email address makes it clear that this is the Dr Stephen Marshall the author of the e-Learning Maturity Model methodology for benchmarking e-learning.

BENVIC

BENVIC is a methodology for benchmarking e-learning developed under an EU project, also called BENVIC (in full, Benchmarking of Virtual Campuses) in the era 1999-2001. There is a project web site still but it has not been updated since February 2002. The BENVIC consortium was led by UOC, the Open University of Catalonia and had a strong set of partners (including University College London in the UK). However, for various reasons including retirement of key staff the work does not seem to have continued – or least web searches indicate that follow-up work is not evident.

The BENVIC system has eight core *meta-indicators*. These are:

- Learner Services
- Learning Delivery
- Learning Development
- Teaching Capability
- Evaluation
- Accessibility
- Technical Capability
- Institutional Capability

All of them, with the exception of Accessibility, are the kind of top-level groupings that one finds in other methodologies. UK readers should also note that Accessibility does not mean only the narrow sense of SENDA but also covers many aspects of Widening Participation.

Each of these eight meta-indicators is associated with a range of assessment measurements (indicators) which enables BENVIC users to carry out an initial benchmarking diagnostic. The assessment measurements are of three types:

- structural measurements
- practice measurements
- performance measurements.

There are in total 72 structural and practice indicators – which is rather more than in many systems but less than some others. Whether or not this is an issue depends crucially on how difficult it is to score these indicators and whether they are all "compulsory".

Indicators (other than the performance ones which are metrically based, i.e. numeric) are scored on a scale of 0-2. Many other systems use a scale of 1-5, but one could use a natural mapping of 0 to 1, 1 to 3, and 2 to 5.

There is a more detailed analyis of BENVIC on the web.

CHIRON

CHIRON is an EU-funded project (under the Leonardo programme) whose aim is "to develop reference material presenting and analysing research outcomes, experiments and best practice solutions for new forms of e-learning, based on integration of broadband web-, digital TV- and mobile technologies for ubiquitous applications in the sector of non-formal and informal life-long learning". They tend to use the phrase "u-learning" rather than "e-learning", where "u" denotes "ubiquity",

As part of this brief, CHIRON appears to be developing a benchmarking methodology. This is specifically referred to in Work Package 7.

There are 11 criteria, divided into a total of 216 indicators. The criteria are as follows:

- 01 Goals and Objectives of the course (12 indicators)
- 02 Institutional Support (14 indicators)
- 03 Course Development (50 indicators)
- 04 Course Structure (12 indicators)
- 05 Course Content (25 indicators)
- 06 Teaching/Learning (19 indicators)
- 07 Student Support (18 indicators)
- 08 Faculty Support (4 indicators)
- 09 Evaluation and Assessment (24 indicators)
- 10 Accessibility (26 indicators)
- 11 Language (12 indicators)

Most of the indicators are best described as specific and rather detailed e-learning standards and guidelines (for example on house style, usability, etc). The remaining few are drawn from a range of sources, including from the Quality on the Line criteria developed in the late 1990s by the Institute for Higher Education Policy in the US.

ELTI

ELTI is the name of one of the methodologies that was trialled in 2006 in the UK Higher Education Academy Benchmarking Pilot, by three universities:

- University of Bristol
- University of Hertfordshire
- University of Wales Institute, Cardiff.

The version of ELTI on which the trials were originally based is the revised 2003 JISC version held at the JISC site. The document ELTI Audit Tools is the most directly relevant to what is commonly accepted as benchmarking, especially section 1 on so-called "Institutional Factors"; however, one at least of the pilot sites took a broader view.

Further details

The ELTI audit was originally developed as part of a JISC project and was designed to inform the process of embedding learning technologies, assist in developing appropriate institutional structures, culture and expertise and to encourage cross boundary collaboration and groupings.

The ELTI approach focuses on:

- 3 general areas for exploration: Culture, Infrastructure, and Expertise
- 12 key factors are identified, 4 in each area
- Up to 10 indicators are agreed, to reflect institutional context, for each factor
- Indicators are expressed as positive statements, which can be assessed according to a 1-5 scale but can also include qualitative statements.

During the e-Learning Benchmarking Pilot the three institutions used the tools and produced alterations and their own contextualised indicators. The three institutional blogs are at:

1. University of Bristol blog
2. University of Hertfordshire blog
3. University of Wales Institute, Cardiff blog.

eMM (e-learning Maturity Model)

The phrase "eMM" is the commonly used abbreviation for the longer phrase e-learning Maturity Model. The E-Learning Maturity Model (eMM) is a quality improvement framework based on the ideas of the Capability Maturity Model (CMM) and SPICE (Software Process Improvement and Capability dEtermination) methodologies. The underlying idea that guides the development of the eMM is that the ability of an institution to be effective in any particular area of work is dependent on their capability to engage in high quality processes that are reproducible and able to be extended and sustained as demand grows.

The eMM provides a set of thirty-five processes, divided into five process areas, tha define a key aspect of the overall ability of institutions to perform well in the delivery of e-learning. Each process is selected on the basis of its necessity in the development and maintenance of capability in e-learning. All of the processes have been created after a rigorous and extensive programme of research, testing and feedback conducted internationally. Capability in each process is described by a set of practices organised by dimension.

The eMM supplements the CMM concept of maturity levels, which describe the evolution of the organisation as a whole, with dimensions. The five dimensions of the eMM are:

1. Delivery
2. Planning
3. Definition
4. Management
5. Optimisation

The key idea underlying the dimension concept is holistic capability. Rather than the eMM measuring progressive levels, it describes the capability of a process from these five synergistic perspectives. An organization that has developed capability on all dimensions for all processes will be more capable than one that has not. Capability at the higher dimensions that is not supported by capability at the lower dimensions will not deliver the desired outcomes; capability at the lower dimensions that is not supported by capability in the higher dimensions will be ad-hoc, unsustainable and unresponsive to changing organizational and learner needs.

Note that the eMM and associated documentation is licensed under a Creative Commons Attribution-ShareAlike 2.5 License.

The eMM is being trialled in the Higher Education Academy Benchmarking Pilot, by the University of Manchester. Additional projects applying the eMM are underway supported by the Scottish Funding Council in Scotland and ACODE in Australia. Development and application of the eMM in New Zealand was supported by the New Zealand Ministry of Education Tertiary E-Learning Research Fund.

E-xcellence

E-xcellence (pronounced “E-excellence”) is an EU-funded project run by EADTU (the European Association of Distance Teaching Universities) with the assistance of 12 other partners.

E-xcellence started in January 2005 and is due to conclude in November 2006, with a major launch at the EADTU conference in Tallinn, Estonia, 23–24 November 2006. Originally E-xcellence was not envisaged as a benchmarking methodology but as a quality monitoring tool, but at arbout a year into the project there was a shift in emphasis and benchmarking is now one of the aims envisaged for E-xcellence. In fact there are three orientations of the methodology:

- Assessment tool (at both institutional and programme level) (i.e. benchmarking)
- Quality improvement tool (internal quality care system)

- Accreditation tool for accreditation

Expected outcomes include:

- List of criteria for "good" e-learning (i.e. setting standards of excellence and indicators for validation)
- Manual on good practices (a web-based guide)
- Quality assurance system (internal validation based on the standard of excellence)
- Reports on pilots which will test the validation approach
- Establishment and training of a visitation team both for quality assurance and for accreditation (to be seen as distinct procedures)

There is little public information so far but it is believed that the basis of the E-xcellence benchmarking methodology is as follows:

1. Based on criteria, with (at the time of writing) 20 *threshold* criteria and a further 30 *excellence* criteria
2. Each criterion is a bundle of indicators
3. Criteria are not yet scored, but this may be added by the time of the final release
4. The threshold" level can be determined by a self-audit, but the "excellence" level requires in addition a visit from an expert team.

IQAT

IQAT - pronounced "eye-cat" - is a newish benchmarking and quality enhancement methodology developed by Hezel Associates, a well-known firm of e-learning consultants, in conjunction with a number of university partners. Unlike most benchmarking methodologies it even has its own web site. The methodology was formally launched in June 2006.

It describes itself as "a web-based tool to track and benchmark institutional data systematically across time and among peer institutions".

The work is being done in partnership with NUTN, the National University Telecommunications Network, and with sponsorship from Cisco Systems. NUTN has for some time had a major interest in quality and more recently benchmarking, as demonstrated for example by the topics and speakers at their 2006 conference. In particular there was a launch presentation of IQAT. One of the leading organisations in NUTN is Michigan State University, who have a leading role in organising an upcoming (October 2006) conference on quality in Beijing, China, entitled the First International Forum on Online Education: Quality Assurance, with a range of quality and benchmarking experts as speakers.

However, probably since it is a commercial and proprietary tool, little further public information appears to be available on IQAT. There are some resources and a glossary on the IQAT site but these appear in the main to be *about* distance learning not about *benchmarking* it, with the exception of a report entitled The Status of Benchmarking at Higher Education Institutions (in the US).

MASSIVE

MASSIVE is an EU-funded project coordinated by the University of Granada.

The prime aim of the project is to design a model of support services for European universities engaged in e-learning. This is being done in a cooperative way involving a large network of organisations, the members of the MASSIVE consortium, tothether with stakeholders not directly participating in the project, who liaise via a Strategic Advisory Committee. The university members of MASSIVE include:

- Universidad de *Barcelona*
- University of *Bergen*
- *Budapest* University of Technology and Economics
- University of *Edinburgh*
- EuroPACE and its member universities

Student involvement is handled via ESIB, the National Unions of Students in Europe.

A key outcome of MASSIVE is to a promote a peer review evaluation approach, based on models widely tested in the university partners. Via Peer Review Visits, those in charge of the best support services practices will help each university to refne and improve their support services for e-learning. At this point the project becomes very similar to a benchmarking project.

MIT90s

The MIT90s framework has been used by the University of Strathclyde (one of the 12 institutions in the Higher Education Academy Benchmarking Pilot) to assist in the structuring of its approach to benchmarking e-learning.

The framework was developed by Michael Scott Morton as part of the work of the "MIT90s" initiative which flourished at MIT in the early 1990s. Michael Scott Morton is now Professor Emeritus at the MIT Sloan School of Management. The work is cited under various names: it is correctly entitled *The Corporation of the 1990s: Information Technology and Organizational Transformation*, edited by Michael Scott Morton with an introduction by Lester Thurow (Oxford University Press, USA).

There has been some confusion over the correct name of the initiative and the framework. Readers will find "MIT 90s", "MIT90" and even "MITs 90" in various references.

The MIT90s framework has been central to a number of JISC and related studies (including from DfES) on adoption and maturity. In UK post-16 e-learning terms, probably the most successful use of this is in the RAIIE study led by David Nicol of the University of Strathclyde, funded by JISC during the period April 2003 to May 2004, which produced a final report *A Framework for Managing the Risks of e-Learning Investment*. There is also a substantial strand of work in Australia associated with the names of Philip Yetton, Anne Forster, Sandra Wills and others,

some of it funded by DETYA. This also used the concept of *strategic alignment* described below.

The MIT90s initiative developed several companion pieces of work o which two are from Venkatraman: *transformation levels* and *strategic alignment*. Professor N Venkat Venkatraman is now Professor of Management at Boston University School of Management (and also a visiting professor at London Business School) but was at the Sloan School of Management at MIT during the period of relevance. His work on *IT-Induced business reconfiguration* is Chapter 5 (pages 122-158) of the main book referred to above.

The Venkatraman thesis is that business use of IT passes through five levels, differing in both the degree of business transformation and in the range (and amount) of potential benefits. The levels are:

- Localised exploitation
- Internal integration
- Business process redesign
- Business network redesign
- Business scope redefinition.

Levels 1 and 2 are called *evolutionary levels* – levels 3, 4, and 5 are called *revolutionary levels*.

This has been applied to educational systems, especially in the schools sector, by Becta and DfES.

In passing, it is interesting that this is one of the first situations where a 5-point scale has been used in a situation akin to benchmarking.

The MIT90s framework could have relevance to e-benchmarking frameworks. In particular, the latest version (2.0) of the Pick & Mix methodology uses the MIT90s framework for tagging its criteria in the Pick&Mix 2.0 release of which a beta description is now available.

OBHE

OBHE is an eponymous benchmarking methodology run by OBHE, the Observatory on Borderless Higher Education. The Observatory is a joint initiative of ACU, the Association of Commonwealth Universities and Universities UK, the association of all UK universities. The Observatory is now 100% funded by subscriptions and consultancy, and has over 130 institutional subscribers from more than twenty countries. It offers a wide range of services of which benchmarking is one. Within the benchmarking offering is a range of sub-offerings, of which one is deployed for the Higher Education Academy clients.

The OBHE methodology is a collaborative benchmarking methodology where a group of institutions get together and jointly agree relevant areasa of interest (in this case, within the e-learning space) and in a later phase, look for good practices. A succinct description of the variant of their methodology used for the Higher Education Academy Benchmarking Pilot is here.

The methodology goes back to benchmarking work done for European and Commonwealth universities in the 1990s. A related study to the Higher Education Academy Pilot is the work done for OECD to produce the report *E-learning in Tertiary Education: Where Do We Stand?* As reported in the Proceedings of the OECD Conference on Post-Secondary E-learning, "This was based on a detailed, qualitative survey of current e-learning practice in 19 institutions of higher education in North America, South America, Europe and the Asia-Pacific region. The information gathered through this survey was complemented by quantitative data collected by OBHE from the 500 members of the Association of Commonwealth Universities and of Universities UK."

Pick&Mix

Pick&Mix (in the past called "Pick & Mix" with spaces) is the name of one of the methodologies being trialled in the Higher Education Academy Benchmarking Pilot, by three universities:

- University of Chester
- University of Leicester
- Staffordshire University

The version of Pick&Mix on which the trials were originally based is version 1.0, first described in a public domain document from the ALT-C 2005 conference and refined slightly to version 1.1 for the Higher Education Academy. During the pilot, after the criterion-setting phase, this was updated to version 1.2.

The release being offered to HEIs for Phase 1 is version 2.0. A beta version of this is described here.

Version 2.0 has benefited substantially from input from the pilot user group of the Universities of Chester, Leicester and Staffordshire, who share in the moral rights of authorship. Released versions of Pick&Mix are in future to be put into the public domain via a Creative Commons license (as was version 1.0 and a summarised literature search).

Pick&Mix was first developed in 2005 after an extensive literature search to suit the needs of Manchester Business School for a comparative methodology for benchmarking e-learning, and a beta version of 1.0 used for a study of 12 comparable institutions to Manchester Business School. The full study is and remains confidential to MBS but a presentation of the highlights was made at the University of Sydney in November 2005.

The recognised abbreviation for Pick&Mix (e.g. as used in tables) is "PnM", although "P&M" is sometimes seen also.

Specific countries

New Zealand

They are using the eMM methodology.

United Kingdom (UK)

In universities, the Higher Education Academy is deploying a small number of methodologies. See their benchmarking page for an entry point to material.

Chapter- 6

M-Learning

The term **M-Learning**, or "mobile learning", has different meanings for different communities. Although related to e-learning and distance education, it is distinct in its focus on learning across contexts and learning with mobile devices. One definition of mobile learning is: *Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies.* In other words mobile learning decreases limitation of learning location with the mobility of general portable devices.

The term covers: learning with portable technologies including but not limited to handheld computers, MP3 players, notebooks and mobile phones. M-learning focuses on the mobility of the learner, interacting with portable technologies, and learning that reflects a focus on how society and its institutions can accommodate and support an increasingly mobile population.

M-learning is convenient in that it is accessible from virtually anywhere. M-Learning, like other forms of E-learning, is also collaborative; sharing is almost instantaneous among everyone using the same content, which leads to the reception of instant feedback and tips. M-Learning also brings strong portability by replacing books and notes with small RAMs, filled with tailored learning contents. In addition, it is simple to utilize mobile learning for a more effective and entertaining experience.

History

Pre-1970s

Arguably the first instance of mobile learning goes back as far as 1901 when Linguaphone released a series of language lessons on wax cylinders. This was followed up in later years as technology improved, to cover compact cassette tapes, 8 track tape, and CDs.

1970s, 1980s

Alan Kay and his colleagues in the Learning Research Group at Xerox Palo Alto Research Center [PARC] propose the Dynabook as a book-sized computer to run dynamic simulations for learning. Their *interim Dynabooks* are the first networked workstations

1990s

Universities in Europe and Asia develop and evaluate mobile learning for students. Palm corporation offers grants to universities and companies who create and test the use of Mobile Learning on the PalmOS platform. Knowledgility creates the first mobile learning modules for CCNA, A+ and MCSE certification using the core tools that later became **LMA.**

2000s

The European Commission funds the major multi-national MOBIlearn and M-Learning projects.

Companies were formed that specialize in three core areas of mobile learning.

1. Authoring and publishing
2. Delivery and Tracking
3. Content Development

Conferences and trade shows were created to specifically deal with mobile learning and handheld education, including: mLearn, WMUTE, and IADIS Mobile Learning international conference series, ICML in Jordan, Mobile Learning in Malaysia, Handheld Learning in London, SALT Mobile in USA.

Analysis (costs / benefits, forecast)

Value

The value of mobile learning --Tutors commented on the value of mobile learning as follows.

- It is important to bring new technology into the classroom.
- It will be more light weight device compare to books, PCs, etc.
- Mobile learning could be utilised as part of a learning approach which uses different types of activities (or a blended learning approach).
- Mobile learning supports the learning process rather than being integral to it.
- Mobile learning needs to be used appropriately, according to the groups of students involved.
- Mobile learning can be a useful add-on tool for students with special needs. However, for SMS and MMS this might be dependent on the students' specific disabilities or difficulties involved.
- Good IT support is needed.

- Mobile learning can be used as a ‘hook’ to re-engage disaffected youth.
- It is necessary to have enough devices for classroom use.

Challenges

Technical challenges include

- Connectivity and battery life
- Screen size and key size
- Ability for authors to visualize mobile phones for delivery
- Possibilities to meet required bandwidth for nonstop/fast streaming
- Number of file/assets' formats supported by a specific device
- Content security or copyright issue from authoring group
- Multiple standards, multiple screen sizes, multiple operating systems
- Reworking existing e-Learning materials for mobile platforms

Social and educational challenges include

- Accessibility and cost barriers for end users: Digital divide.
- How to assess learning outside the classroom
- How to support learning across many contexts
- Content's security (or) pirating issues
- Frequent changes in device models/technologies/functionality etc.
- Developing an appropriate theory of learning for the mobile age
- Conceptual differences between e- and m-learning
- Design of technology to support a lifetime of learning
- Tracking of results and proper use of this information
- No restriction on learning timetable
- Personal and private information and content
- No demographic boundary
- Disruption of students' personal and academic lives
- Access to and use of the technology in developing countries

Growth

Over the past ten years mobile learning has grown from a minor research interest to a set of significant projects in schools, workplaces, museums, cities and rural areas around the world. The mLearning community is still fragmented, with different national perspectives, differences between academia and industry, and between the school, higher education and lifelong learning sectors.

Current areas of growth include:

- Testing, surveys, job aids and just-in-time (J.I.T.) learning
- Location-based and contextual learning
- Social-networked mobile learning

- Mobile educational gaming
- Deliver M-Learning to cellular phones using two way SMS messaging and voice-based CellCasting (podcasting to phones with interactive assessments)

According to a report by Ambient Insight in 2008, "the US market for Mobile Learning products and services is growing at a five-year compound annual growth rate (CAGR) of 21.7% and revenues reached $538 million in 2007. The data indicate that the demand is relatively immune from the recession." The findings of the report indicate that the largest demand throughout the forecast period is for custom development services, content conversion, and media services and that the healthcare sector accounts for 20% of the total US market for mobile learning.

Future

Technologies currently being researched for mobile learning include:

- Location aware learning
- Point-and-shoot learning with camera phones and 2D codes
- Near Field Communications (NFC) secure transactions
- Sensors and accelerometers in mobile devices in behavioral based learning
- Mobile content creation (including user generated content)
- Games and simulation for learning on mobile devices
- Context-aware ubiquitous learning
- Augmented reality on mobile devices

Delivery

Smartphones are one of the platforms used for mobile learning

While many think of mobile learning as delivering eLearning on small form factor devices, or often referred to as eLearning "lite", it has the potential to do much more than deliver courses, or parts of courses. It includes the use of mobile/handheld devices to perform any of the following:

- Deliver Education/Learning
- Foster Communications/Collaboration
- Conduct Assessments/Evaluations
- Provide Access to Performance Support/Knowledge

- Capture Evidence of Learning Activity

Today, any number of portable devices can quickly and easily deliver and support these functions. Cell or smartphones, multi-game devices, personal media players (PMPs), personal digital assistants (PDAs), or wireless single-purpose devices can help deliver coaching and mentoring, conduct assessments and evaluations (e.g., quizzes; tests; surveys/polls; and certifications), provide on-the-job support and access to information, education and references, and deliver podcasts, update alerts, forms and checklists. In these ways, mobile learning can enhance and support more traditional learning modes, making it more portable and accessible. Mobile devices can also serve as powerful data collection tools and facilitate the capture of user created content.

Approaches

The use of mobile learning in the military is becoming increasingly common due to low cost and high portability.

In the classroom

- Students using handheld computers, PDAs, smartphones or handheld voting systems (such as clickers) in a classroom or lecture room (Tremblay 2010).
- Students using mobile devices(such as a Pocket PC) in the classroom to enhance group collaboration among students and instructors.

For blended learning

Mobile learning can provide support that enhances training in a corporate business or other classroom environment.

Class management

The mobile phone (through text SMS notices) can be used especially for distance education or with students whose course requires them to be highly mobile and in particular to communicate information regarding availability of assignment results, venue changes and cancellations, etc. It can also be of value to business people e.g. sales representatives who do not wish to waste time away from their busy schedules to attend formal training events.

Podcasting

Podcasting consists of listening to audio recordings of lectures, and can be used to review live lectures (Clark & Westcott (2007) and to provide opportunities for students to rehearse oral presentations. Podcasts may also provide supplemental information to enhance traditional lectures (McGarr 2009) (Steven & Teasley 2009).

Psychological research suggests that university students who download podcast lectures achieve substantially higher exam results than those who attend the lecture in person, but only in cases in which students take notes (Callaway & Ewen 2009).

Podcasts maybe be delivered using syndication, although it should be noted that this method of delivery is not always easily adopted (Lee, Miller & Newnham 2009).

Outdoor

- Learning in museums or galleries with handheld or wearable technologies
- Learning outdoors, for example on field trips.
- Continuous learning and portable tools for military personnel.

At work

- On the job training for someone who accesses training on a mobile device "just in time" to solve a problem or gain an update.

Life long learning and self-learning

The use of personal technology to support informal or lifelong learning, such as using handheld dictionaries and other devices for language learning.

Mobile technologies and approaches, i.e. Mobile Assisted Language Learning (MALL), are also used to assist in language learning. For instance handheld computers, cell phones, but also podcasting (Horkoff Kayes2008) have been used for helping people to acquire a language.

Other

- Improving levels of literacy, numeracy and participation in education amongst young adults.
- Using the communication features of a mobile phone as part of a larger learning activity (e.g.: sending media or texts into a central portfolio, or exporting audio files from a learning platform to your phone)

Technologies

Mobile devices and personal technologies that can support mobile learning, include:

- E-book
- Handheld audio and multimedia guides, in museums and galleries
- Handheld game console, modern gaming consoles such as Sony PSP or Nintendo DS
- Personal audio player, e.g. for listening to audio recordings of lectures (podcasting)
- Personal Digital Assistant, in the classroom and outdoors
- Tablet PC
- UMPC, mobile phone, camera phone and SmartPhone

Technical and delivery support for mobile learning:

- 3GP For compression and delivery method of audiovisual content associated with Mobile Learning
- GPRS mobile data service, provides high speed connection and data transfer rate
- Wi-Fi gives access to instructors and resources via internet

Authoring:

- Learning Mobile Author, e.g. for authoring and publishing WAP, Java ME and Smartphone

Relevant organisations

- The International Association for Mobile Learning
    - The International Association for Mobile Learning (IamLearn) has been formed as a membership organization to promote excellence in research, development and application of mobile and contextual learning. It organizes the annual mLearn international conference series. IamLearn manages a website to collate and disseminate information about new projects, emerging technologies, and teaching resources.

Mobile Assisted Language Learning

Definition

Mobile Assisted Language Learning (MALL) describes an approach to language learning that is enhanced through use of a mobile device. MALL a subset of both Mobile Learning (m-learning) and Computer-assisted language learning (CALL). MALL involved with the use of the mobile technologies, such as mobiles phones, MP3 /MP4 players, PDAs and palmtop computers, to support students' language learning. With MALL students are able to access language learning materials, and to communicate with their teachers and peers, at anytime, anywhere.

History

1980s

- Twarog and Pereszlenyi Pinter used telephones to provide distant language learners with feedback and assistance.

1990s

- Instructors at Brigham Young University-Hawaii taught a distance education English course from Hawaii to Tonga via telephone and computer (Green, Collier, & Evans, 2001)

2000s

- Dickey (2001) utilized teleconferencing to teach an English conversation course to students in South Korea.
- Stanford University learning lab used integrated mobile phones in a Spanish learning program in 2001 (Brown, 2001).
- Thornton and Houser (2002; 2003; 2005) developed several innovative projects using mobile phones to teach English at a Japanese university. They also developed a course management system, Poodle, to facilitate deploying language learning material to mobile phones.
- City College, Southampton developed a web based "media board" (similar to a web-board but supporting Multimedia Messaging Service (MMS) as well as Short Message Service (SMS) and supplied learners of English as a Second Language (ESL) with mobile phones with inbuilt cameras and voice recording facilities (JISC, 2005).
- University of Wisconsin–Madison, developed several foreign language courses which have used wireless handheld computers for various classroom activities (Samuels, 2003).
- Duke University provided all incoming freshmen with free iPods equipped with voice recorders. Amongst the pilot courses utilizing the players were several language courses, which utilized both their listening and recording capabilities (Belanger, 2005).

- United Kingdom's Open University used voice recorders and mini-camcorders to record interviews with other students and locals and to create audiovisual tours in distance-learning German and Spanish course (Kukulska-Hulme, 2005). The Open University also recently used mobile phones for language learning
- A project in Ireland used MALL for Irish Language learning and assessment
- The Le@rning Federation (TLF) used MALL for Indonesian Language learning across three states
- The first mobile phone language learning service opens for business in English providing lessons in Italian, Spanish, German and French, providing 60 text message (SMS) lessons for €9.

Current Trends

Today, due to the growth of wireless and emerging technologies, MALL is available through numerous devices including mobile phones, iPods, tablet PCs, hand-held computers, PDAs, MP3 players, Smartphones and more. MALL designers have begun to move away from merely copying the traditions of standard non-mobile language learning and are implementing techniques that maximize the benefits of these new devices. The increasing number of possible delivery tools has spawned a wide-range of mobile language learning programs, from very-short tutorials to full courses. The number of people capable of producing MALL content is also on the rise, due largely to a combination of increased popularity, demand and the advent of content generation tools that simplify the programming process through the use of templates and macros.

MALL currently serves not only as a primary source of language education for students but also supports the retention and utilization of newly-acquired language skills—however they were acquired. Through mobile participation in short exercises and tasks, learners are able to keep their linguistic talents sharp while reducing the risk of degradation of valuable knowledge, skills and abilities.

The Future of MALL

Consensus among the limited literature and studies available specifically about MALL indicate that the demand for it will only increase—along with the demand for second language acquisition and learning flexibility. Predicted growth is reinforced by the overall decrease in free time. With people working longer hours, the time necessary for formal, traditional classroom-based or even standard online courses will decrease. MALL will be an ideal solution to busy students and professionals seeking to acquire one or more new languages.

What mobile devices lack in capability (regarding sound and video quality and screen size) they make up for in portability. In the future, however, we can expect mobile devices to deliver better quality than is currently available among most mobile devices. It is expected that designers will capitalize on this increase in quality—designing MALL programs that employ student-focused, media-rich, flexible and collaborative learning strategies. Additionally, changes in the cost and availability of wireless service—a luxury to most in the not-too-distant past—will make MALL available to a far wider and diverse audience.

MALL Professional Organizations

At the writing of this chapter, it is difficult to find organizations that focus specifically on Mobile Assisted Language Learning. Some of the resources for MALL are primarily language learning websites with some space dedicated to technology in language learning. Other resources are primarily educational technology websites that dedicate some of their efforts to language learning.

- Handheld Learning – Promotes learning with mobile or ubiquitous technologies. Their conference is the international signature event for learning using mobile or ubiquitous technologies.
- SALT conference include sessions on learning languages over mobile phones
- Mobile Learning Global Consortium – This LinkedIn group serves as a collaborative forum for the ways and methods being used to push the envelope beyond the cutting edge of mobility, which help people learn, connect, and achieve, as it relates to academia, government, industry, and the mass consumer market.
- WMUTE - Wireless, Mobile and Ubiquitous Technologies in Education. WMUTE provides opportunity for communication among local and international researchers, and for researchers to be acquainted with the market needs related to mobile learning.

Collaborative Learning in MALL

Collaborative learning is the acquisition of knowledge, skills or attitudes occurring in individuals as a result of group interaction. Collaborative learning is a student-centered approach to learning where the instructor is more like a facilitator than a teacher.

Unlike other techniques collaborative learning encourages all involved to help support and motivate each other to achieve the learning goal. Because the collaborative learning is student-centered it often succeeds in engaging the learner. A language can be learned through collaborative learning with the use of mobile devices But mobile devices don't actually drive the learning, learners do. The devices, be they phones, palm pilots or laptops, are used as tools, like a pencil or calculator, to accentuate or aid the learning process.

Duke University's use of iPods in 2004 is an example of using collaborative learning in MALL. The university provided a new tool for the students, particularly those taking a language course. The students in language courses used the iPods in various ways, including working collaboratively with language tutors. The students would record themselves completing an oral assignment and the tutors provided feedback on their assignment. The students also used the iPods to record conversations in the language they were learning, downloading podcasts, store and listen to songs in the language they were learning.

Collaborating on mobile devices is dependent on the device. The following are examples of collaborative learning using mobile devices:

- Collaboration on a mobile phone can be achieved by asynchronous text messaging and instant messaging or a phone conversation. In each instance learning can take place but the phones serve only as the delivery method for that information.
- A tablet PC or a PDA can allow learners to collaborate on documents while at different locations, find information from multiple sources to build ideas with partners, and make information about learning activities portable and easily accessible.

The effectiveness of collaborating varies on the project and mobile device.

Affordances and Constraints

Enhancing language learning through MALL affords some dynamics not available through the traditional classroom that the language learner can take advantage of. Some of these affordances are even unique to m-learning compared to regular e-learning. In the same way, there are some constraints to m-learning that limit what can be done in language acquisition through m-learning compared to traditional e-learning or classroom learning.

Among the most noted affordances for MALL is ubiquitous access to learning anytime at any place that the user has reception. Compared to classroom or e-learning, the user does not need to be sitting in a classroom or at a computer to access learning materials. This enables users to brush up on language skills just before or just after a conversation in the language they are learning. Handheld delivery also affords new dynamics for collaborative learning as users can share the language learning process in small synchronous groups (Nah, et al. 2008).

Kloper et al. (2002) claimed 5 properties of mobile devices which can produce unique educational affordances:

- Portability-the small size and weight of mobile devices means they can be taken to different sites or moved around within a site.
- Social interactivity-data exchange and collaboration with other learners can happen face-to-face.
- Context sensitivity-mobile devices can both gather and respond to real or simulated data unique to the current location, environment and time.
- Connectivity-a shared network can be created by connecting mobile devices to data collection devices, other devices or to a common network.
- Individuality- scaffolding for difficult activities can be customized for individual learners.

The most notable constraints for earlier MALL include poor sound and display quality coupled with very limited devices and download speeds. Newer integrated PDA devices have narrowed the gap with higher access speeds, larger screens, having functions and capacities similar to laptop computers (Nah, et al. 2008).

Chapter- 7

Educational Programming Language

An **educational programming language** is a programming language that is designed primarily as a learning instrument and not so much as a tool for writing real-world application programs.

Learning Paths

Many educational programming languages position themselves inside a learning path, that is a sequence of languages each designed to build on the others moving a student from easy to understand and entertaining environments to full professional environments. Some of the better known are presented below.

Smalltalk/Squeak based

As part of the One Laptop per Child project, Smalltalk has developed a flow of languages each designed to act as an introduction to the other. The structure is Scratch to Etoys to Squeak to any Smalltalk. Each provides graphical environments which may be used to teach not only programming concepts to kids, but also physics and mathematics simulations, story-telling exercises, etc., through the use of constructive learning. Smalltalk and Squeak are fully featured application development languages that have been around and well respected for decades; Scratch is a children's learning tool.

- **Scratch** is a visual programming language based on and implemented in Squeak. It has the goal of teaching programming concepts to children and letting them create games, videos, and music. In Scratch, all the interactive objects, graphics, and sounds can be easily imported to a new program and combined in new ways. That way, beginners can get quick results and be motivated to try further. The Scratch community has developed and uploaded over 1,330,000 projects. It is developed at MIT Media Lab.

- **Etoys** is based on the idea of programmable virtual entities behaving on the computer screen. Etoys provides a media-rich authoring environment with a simple, powerful scripted object model for many kinds of objects created by end-users. It includes 2D and 3D graphics, images, text, particles, presentations, web-pages, videos, sound and MIDI,

the ability to share desktops with other Etoy users in real-time, so many forms of immersive mentoring and play can be done over the Internet. It is multilingual, and has been used successfully in United States, Europe, South America, Japan, Korea, India, Nepal, and elsewhere. The program is aimed at children 9-12

- **Squeak** is a modern, open source, full-featured implementation of the Smalltalk programming language and environment. Smalltalk is an object-oriented, dynamically typed, reflective programming language created as the language to underpin the "new world" of computing exemplified by "human–computer symbiosis." Like Lisp, it has image-based persistence, so everything is modifiable from within the language itself. It has greatly influenced the industry introducing many of the concepts in object-oriented programming and just-in-time compilation. Squeak is the vehicle for a wide range of projects including multimedia applications, educational platforms and commercial web application development. Squeak is designed to be highly-portable and easy to debug, analyze, and change, as its virtual machine is written fully in Smalltalk. The main site maintains a list of free tutorials, and Stéphane Ducasse maintains a large collection of Free Online Books related to Smalltalk and Squeak. The commonly used professional language in greatest use today which incorporates many of Smalltalk's ideas is Objective-C.

Java based

Sun's recommended path is Greenfoot to BlueJ to Netbeans/BlueJ to Netbeans/Java

- **Greenfoot** is an interactive Java development environment developed primarily for educational purposes. It allows easy development of two-dimensional graphical applications, such as simulations and interactive games. It is mainly aimed at programming education (object-oriented programming with Java) at high school and early university level.

- **BlueJ** is an integrated Java environment specifically designed for introductory teaching, first year college student. It eliminates some of Java's complex syntax, the difficulties of I/O and represents the object/class relationships visually. The BlueJ environment was developed as part of a university research project about teaching object-orientation to beginners (the Blue system). The aim of BlueJ is to provide an easy-to-use teaching environment for the Java language that facilitates the teaching of Java to first year students. Special emphasis has been placed on visualization and interaction techniques to create a highly interactive environment that encourages experimentation and exploration.

- **NetBeans BlueJ Edition** is an integrated development environment (IDE) meant to transition students from the introductory IDE BlueJ to the more professional IDE NetBeans. Sun provides a free curriculum, designed for and tested in high schools for use in teaching Java/BlueJ.

- **NetBeans / Java** This is a professional level platform. NetBeans refers to both a platform for the development of applications for the network, and an integrated development

environment (IDE) developed using the NetBeans Platform. The NetBeans Platform is a reusable framework for simplifying the development of other desktop applications. The platform offers services common to desktop applications, allowing developers to focus on the logic specific to their application. The NetBeans IDE is an open-source integrated development environment written entirely in Java using the NetBeans Platform. NetBeans IDE supports development of all Java application types (Java SE, web, EJB and mobile applications) out of the box. Among other features are an Ant-based project system, version control and refactoring.

Lisp based

Lisp is the second oldest family of computer languages in use today, and as such has a host of dialects and implementations at a wide range of difficulties. Lisp was originally created as a practical mathematical notation for computer programs, based on lambda calculus, which makes it particularly well suited for teaching theories of computation. As one of the earliest programming languages, Lisp pioneered many ideas in computer science, including tree data structures, automatic storage management, dynamic typing, object-oriented programming, and the self-hosting compiler all of which are useful for learning computer science.

The name *LISP* derives from "LISt Processing language". Linked lists are one of Lisp languages' major data structures, and Lisp source code is itself made up of lists. As a result, Lisp programs can manipulate source code as a data structure, giving rise to the macro systems that allow programmers to create new syntax or even new domain-specific languages embedded in Lisp. So Lisps are useful for learning language design, and creating custom languages.

A reasonable learning path would be Logo followed by any educational variant such as Scheme or newLISP, followed by a professional variant such as Common LISP.

- **Logo** is a language that was specifically designed to introduce children to programming. The first part of learning Logo deals with "turtle graphics" (derived from turtle robots used as early as 1969 with proto-Logo. In modern implementations, an abstract drawing device, called the *turtle*, is used to make programming for children very attractive by concentrating on doing turtle graphics. Seymour Papert, the inventor of Logo, was a major thinking in constructionism, a variety of constructivist learning theory. Papert argued that activities like writing would naturally be learned by much younger children providing that they adopted a computation culture. Logo was thus designed not only to teach programming, and computation concepts but to enhance a child's entire well being in a culture increasingly dominated by technology, "*more important than having an early start on intellectual building is being saved from a long period of dependency during which one learns to think of learning as something that has to be dished out by a more powerful other...Such children would not define themselves or allow society to define them as intellectually helpless.*" It has been used with children as young as 3 and has a track record of 30 years of success in education. Since Logo is actually a streamlined version of LISP with more advanced students it can be used to introduce the basic concepts of Computer Science and even Artificial Intelligence. Brian Harvey wrote a series *Computer Science Logo Style* for self study of computer science based on Logo.

Logo is widely available on virtually every platform, in both free and commercial versions.

- **Scheme** was originally designed in 1975 to serve a tutorial purpose. Guy L. Steele, Jr. and Gerald Jay Sussman constructed Scheme as a fast interpreted language on top of an underlying LISP with cheap procedure calls. Pedagogically this allowed for teaching programming in terms of domain-specific languages and meta-circular evaluators. The publication of Structure and Interpretation of Computer Programs in 1984 incorporated this educational philosophy into a canonical textbook, which changed the predominance of Pascal as the university programming language.

> “The publication of Abelson and Sussman’s Structure and Interpretation of Computer Programs (sicp) (Abelson et al., 1985) revolutionized the landscape of the introductory computing curriculum in the 1980s. Most importantly, the book liberated the introductory course from the tyranny of syntax. Instead of arranging a course around the syntax of a currently fashionable programming language, sicp focused the first course on the study of important ideas in computing: functional abstraction, data abstraction, streams, data-directed programming, implementation of message-passing objects, interpreters, compilers, and register machines.
>
> Over a short period, many universities in the US and around the world switched their first course to sicp and Scheme. The book became a major bestseller for MIT Press. Along with sicp, the Scheme programming language (became widely used. It was no longer the subject of a few individual courses at Indiana University, MIT, and Yale, but the language of choice in introductory courses all over the world.”

Since then the Scheme community has introduced several pedagogic programming environments for less advanced courses of particular notes it the PLT Scheme outreach effort with its DrScheme environment, freely available text How to Design Programs and TeachScheme! educator training.

- **newLISP** aims to provide a fast, powerful, cross-platform, full-featured scripting version of the Lisp programming language which uses only a modest amount of system resources such as disk space and memory. It is particularly suited for learners because of its simple, consistent, streamlined, Lisp environment that minimizes the learning curve and maximizes programmer productivity and pleasure.

- **Common Lisp** Common Lisp is a general-purpose (professional), multi-paradigm programming language. It supports a combination of procedural, functional and object-oriented programming paradigms. As a dynamic programming language, it facilitates rapid development, with iterative compilation into efficient run-time programs. Common Lisp is different from most other professional languages in the use of S-expressions to denote both code and data structure. Function and macro calls are written as lists, with the name of the function first. Developed to standardize the divergent variants of Lisp which predated it, it is not an implementation but rather a language specification. Several implementations of the Common Lisp standard are available, including proprietary products and open source software.

BASIC

BASIC is a language invented in 1964 to provide computer access to non-science students. It became popular on mini computers during the 1960s, and became the standard computing language for microcomputers during the late 1970s and early 1980s. The goals of BASIC were focused on the needs of learning to program easily: be easy for beginners to use, be interactive, provide clear and friendly error messages, respond quickly, do not require an understanding of computer hardware or operating systems. What made basic particularly useful for education was the small size of programs. Useful programs to illustrate a concept could be written in a dozen lines. At the same time BASIC did not require mathematical or computer science sophistication. BASIC continues to this day to be a language which is frequently self taught with excellent tutorials and implementations. BASIC offers a learning path from learning oriented BASICs such as Microsoft Small Basic, BASIC-256 and SiMPLE, to more full featured BASICs like Visual Basic .NET and Gambas.

- **Visual Basic .NET** with a freely available Visual Basic Express Edition including an K-12 learning center and Beginner adult learning center

- **Microsoft Small Basic** is an restricted version of Visual Basic designed as a first programming language, "aimed at bringing 'fun' back to programming". The language is explicitly quite small with only 15 keywords and each of them is quite natural. Object specific libraries for things of general interest and of interest to kids (for example Flickr) children are able to create entertaining interactive programs, on the net or on the desktop. The system utilizes the Microsoft Visual Studio IDE to provide auto-completion and context sensitive help.

- **BASIC-256** an easy to use version of BASIC designed to teach young children the basics of computer programming. It uses traditional BASIC control structures (gosub, for loops, goto) for ease of understanding program flow-control. It has a built-in graphics mode that allows children to draw pictures on screen after minutes. It includes tutorials that introduce programming concepts through fun exercises.

- **SiMPLE** is a programming development system that was created to provide easy programming capabilities for everybody, especially non-professionals. SiMPLE is vaguely reminiscent of the AppleSoft BASIC. SiMPLE is a compiled language. In addition, SiMPLE allows users to create their own libraries of frequently used functions. "Simple" is a generic term for three slightly different versions of the language: Micro-SiMPLE to use only 4 keywords, Pro-SiMPLE, and Ultra-SiMPLE use of 23 keywords.

Children

- **AgentSheets** is an award winning game and simulation authoring tool that is simple enough to be used by middle school students to learn about computer science by making video games, yet sophisticated enough to allow NASA scientist to create simulations of Space Shuttle payload. AgentSheets is supported through a complete curriculum called Scalable Game Design starting with simple Frogger-like games all the way up to Sim-like

games with sophisticated Artificial Intelligence. AgentSheets supports game (animation, interaction, sound, speech synthesis/recognition (Mac)) and well as science applications (plots, output to spreadsheets, 3D plot (Mac)). English, Greek, and Japanese versions are available. AgentSheets formed the basis for LegoSheets a programming language for the Lego Mindstorms. which had a less steep learning curve than Brick Logo

- **Alice** is a free programming software designed to teach event driven object oriented programming to children. Programmers create interactive stories using a modern IDE interface with and a drag and drop style of programming. The target audience is middle school girls though most children with computer experience will find it entertaining and educational. A variant of Alice designed with an even stronger story telling bent called Story Telling Alice is also available.

- **Baltie** is an educational graphic oriented programming tool for children, youth (and adults). Baltie is also main character of this software a little wizard keen to execute miscellaneous commands and to conjure pictures (tiles) in his scene. With Balties help children will quickly realize what is a computer and how to master and program the computer. All that by playing. Baltie can be used also for exercising logical thinking. It makes no demands on childs knowledge, only playfulness and imagination are required. It is used in many countries in the basic schools. The new version of Baltie 4 fully supports C#. Additional usage information can be found at the (SGP Systems).

- **CiMPLE** is a Visual Programming Language for programming robotic kit for children. It is built on top of C as a DSL. ThinkLabs an Indian Robotics edication based startup has built it for iPitara Robotic kit. CiMPLE visual language bears strong resemblance to written C programming language. Approximately 5000+ students in India have brought the iPitara kit and programmed it using CiMPLE. Additional information at (CiMPLE Original Developers Weblog) and (Robo.in).

- **E-Slate** is an exploratory learning environment. It provides a workbench for creating highly dynamic software with rich functionality,by non-programmers. Educational activity ideas can be turned into software with minimal authoring effort in the form of interactive Microworlds which contain specially designed educational components. E-Slate components are provided as a kit of pre-fabricated, interoperable computational objects. Software Microworlds can be very easily constructed by plugging components in various configurations. The behaviour of both components and Microworlds, can be programmed in a Logo-based scripting language. E-Slate is currently based on the Java platform and related technologies. Additional information and download can be found at (RA-CTI / Greek Ministry of Education).

- **Guido van Robot** is a robot control program similar to Logo or Karel J. Robot, with a minimal Python syntax. It is designed to be minimalistic and generic to any high level language. There is a variant that includes the full Python syntax and a canonical set of lessons called RUR-PLE.

- **Karel**, **Karel++**, and **Karel J. Robot** are languages aimed at absolute beginners, used to control a simple robot in a city consisting of a rectangular grid of streets. While Karel is its own programming language, Karel++ is a version of Karel implemented in C++, while Karel J. Robot is a version of Karel implemented in Java.
- **Kodu** is a language that is simple and entirely icon-based. The project was incubated out of Microsoft Research as a project to reach younger children and especially girls into enjoying technology. Programs are composed of pages, which are broken down into rules, which are further divided into conditions and actions. Conditions are evaluated simultaneously. The Kodu language is designed specifically for game development and provides specialized primitives derived from gaming scenarios. Programs are expressed in physical terms, using concepts like vision, hearing, and time to control character behavior. While not as general-purpose as classical programming languages, Kodu can express advanced game design concepts in a simple, direct, and intuitive manner. The Kodu tool is available in three forms: PC as a free download in public beta and academic forms as well as a low-cost Xbox 360 Live download.
- **Learn to Program BASIC** is a BASIC interpreter with an interactive course intended to teach the language to middle school students. Game-specific additions to the BASIC language include 2D sprite support. Programs written in "LTPB" could be executed on computers without the software by means of a freely-distributable "runner".
- **Lego Mindstorms** is a line of Lego sets combining programmable bricks with electric motors, sensors, Lego bricks, and Lego Technic pieces (such as gears, axles, and beams). Mindstorms originated from the programmable sensor blocks used in the line of educational toys. The first retail version of Lego Mindstorms was released in 1998 and marketed commercially as the Robotics Invention System (RIS). The current version was released in 2006 as Lego Mindstorms NXT. A wide range of programming languages is used for the mindstorms from Logo to BASIC to derivatives of Java, Smalltalk and C. The Mindstorm approach to programming now have dedicated physical sites called Computer Clubhouses.

- **Mama** is an educational object oriented programming language designed to help young students start programming by providing all the language elements in the student mother tongue. Mama programming language is available in several languages, with both LTR and RTL language direction support. A new variant of Mama was built on top of Carnegie Mellon's *Alice* development environment, supporting scripting of the 3D stage objects. This new variant of Mama was designed to help young students start programming by building 3D animations and games. A document about educational programming principles explains Mama's design considerations.

- **Phrogram** (the second generation product of *Kid's Programming Language*) is a commercial easy-to-learn programming language and Integrated Development Environment introduced in 2006. It emphasizes graphics and sounds, making it especially easy to develop games and entertaining educational material. Phrogram is a simplified structured language, and offers component-based development features such as classes and methods. It is modeled on modern IDEs such as Eclipse and Visual Studio. NET, and intends to prepare a beginner to graduate to these or other professional development environments.

- **RoboMind** is a simple educational programming environment that lets beginners program a robot. It introduces popular programming techniques and also some robotics and artificial intelligence. The robot can be programmed in Arabic, Chinese, Dutch, English and Swedish.
- **Stagecast Creator** is a visual programming system based on programming by demonstration. Users demonstrate to the system what to do by moving icons on the screen, and it generates rules for the objects (characters). Users can create two-dimensional simulations that model a concept, multi-level games, interactive stories, etc.

Historical

- **Pascal** is the most well-known programming language that was designed with education in mind. From the late 1970s to the late 1980s, it was the primary choice in introductory computer science classes for teaching students programming in both the US and Europe. Its use for real-world applications has since increased, and regarding it as a purely educational programming language has since become somewhat controversial.

University

- **A++** represents a more recent attempt at creating a programming language designed to provide an efficient tool for basic training in programming.

- **Curry** is a teaching language designed to amalgamate the most important declarative programming paradigms, namely functional programming (nested expressions, higher-order functions, lazy evaluation) and logic programming (logical variables, partial data structures, built-in search). It also integrates the two most import operational principles developed in the area of integrated functional logic languages: “residuation” and “narrowing”.
- **Haskell** is often used by universities in place of LISP or Scheme. Its primary goal was to function equally well as a language for teaching, research and application design. It is a purely functional, extremely expressive lazy functional programming language. Sample courses are available online, as are multiple books and tutorials. An education specific compiler / IDE, called Helium has been created. Another advantage of Haskell is in teaching inductive methods. Because of the advantages of Haskell's syntax inductive proofs become as easy or easier as they are on paper, unlike the LISP/Scheme family which introduces additional syntax.

- **M2001** is a modular mathematical language for developing and presenting mathematical algorithms, from modern discrete to classical continuous mathematics. It is built on a semantic framework based in category theory, with a syntax similar to that of Pascal or Modula-2. It is designed for education only, so efficiency and ease of implementation are far less vital in its development than generality and range of application. It was created to play a strong role in forming a formal algorithmic foundation for first-year college math students.

- **Oz** is a programming language designed to teach computer theory. It supports most major paradigms in a single language so that students can learn paradigms without having to learn multiple syntaxes. Oz contains in a simple and well-factored way most of the concepts of the major programming paradigms, including logic, functional (both lazy and eager), imperative, object-oriented, constraint, distributed, and concurrent programming. It has a canonical textbook Concepts, Techniques, and Models of Computer Programming and a freely available standard implementation the Mozart Programming System.

- **Qi II** is a functional programming language. The Qi core language is a simplification of the Lisp language, but it includes most of the features common to modern functional programming languages such as pattern matching, currying, partial applications, guards and (optional) static type checking. It also includes an embedded Prolog as part of the distribution called *Qi Prolog*. The combination of all these features within the Lisp environment makes Qi in many senses a rationalization and modernization of Lisp. Qi is free for non commercial use, and has a free canonical textbook Functional Programming in Qi.

Languages by age and experience

The following chart helps to summarize the information above for parents and teachers.

Age	Experience Level	Appropriate Languages
Preschool - 2nd grade	None / Not applicable	Logo style: Logo, Guido van Robot, Karel, Scratch, Baltie 2, Stagecast Creator
2nd grade - 4th grade	None / Not applicable	Logo, Scratch or Etoys, Stagecast Creator
5th grade - 8th grade	Little or no experience	Lego Mindstorm, Etoys, AgentSheets, Alice, Baltie 3, learning oriented BASIC, Phrogram, Stagecast Creator, Mama
5th grade - 8th grade	Some experience	Squeak, full featured BASIC, Greenfoot, Pascal, Mama
High School	Little or no experience	Squeak, Greenfoot, Pascal, full featured BASIC, Mama
High School	Some Experience	Squeak, Greenfoot or BlueJ, newLISP, Mama, OZ, Most other programming languages
College	non majors course, no experience assumed	Squeak, Greenfoot or BlueJ, newLISP, full featured BASIC
College	Starting computer science or developer curriculum	Haskell, OZ, Scheme, Qi, Squeak, NetBeans BlueJ.