Platforms for e-learning

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Introduction

Virtual learning environments (VLEs) are increasingly becoming an important part of the strategy for delivering online and flexible learning. Many institutions already have VLEs in place, though relatively few are using them with large numbers of students. Some institutions are still trying to decide what type of VLE to implement. “Learning platform” is a generic term used to describe a range of integrated Web-based applications. These can include Web pages, e-mail, message boards, text and videoconference, shared diaries, online social areas, and assessment tools.

In this article we describe the different types of e-learning tools, what a “platform for e-learning” actually does, what problems it solves, as well as the ways in which platforms for e-learning (or elements of them) are used, or are planned to be used. Finally, we refer to the technical specifications of the most important platform software and systems currently available, and compare them by listing the relevant advantages and disadvantages of each item.

E-learning refers to learning resources derived from the application of information and communication technologies to the educational environment.

Learning is a social process involving the active construction of new knowledge and understanding through individual learning and group and peer interaction [1]. This means that an important learning skill is communication.

E-learning utilizes computers and computer networks as a channel of communication additional and complementary to conventional channels. This communication channel connects learners with learning media, other people, data, and processing power.

The main use of information technologies is to create tools supporting learning activities. Those tools can be divided into two main categories. The tools created are used for:

- Learning content transmission
- Communication support

E-learning delivers many enhancements to the teaching and learning experience; the largest impact occurs when the technology enables social and collaborative interaction where an individual person, students, or parties build actively their understanding [2]. There are a multitude of e-learning tools available today. With the growth in e-learning that we are seeing now, every computer application that touches the Internet, and some that do not, has the potential to be an e-learning tool.

A physical learning environment generally integrates courses, resources (libraries), formal communication (boards), informal communication (cafeteria), administration, etc. Similarly, a VLE integrates a variety of tools supporting multiple functions: information, communication, collaboration, learning, and management. The very idea of environment includes this notion of integration. Referring to the architecture, VLEs are well-structured information spaces.

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Synchronous and asynchronous communication

Ellis et al. [3] categorized group interactions according to time and space (Fig. 1). Generally, communication technologies can provide place-independent communication and time-independent communication.

Synchronous communication tools are used in same time/different place situations when participants are located in (at least two) different places, and communicate via computers using chat rooms or desktop video and Web conferences in real time. Using synchronous communication tools, students can share data and views through the Internet in real-time like a face-to-face interaction without feeling isolated [4]. Common synchronous communication tools are videoconference and Web conference, where users receive a response within seconds or minutes. One of the challenges to communication technology is how to make distributed interactions as effective as face-to-face interactions, since the creation of mutual understanding or shared values and goals are hard to produce in a distant environment. A remote interaction supported by appropriate technology, which will allow students to have access to other relevant information without interrupting the interaction flow, should be the solution to the challenge.

An asynchronous communication tool is used in different time/different place situations and refers to dispersed teams that rarely meet face-to-face, and conduct all their work through computer-mediated communication systems that provide a combination of database, e-mail, and forum capabilities. Examples of asynchronous communication tools are learning management systems (LMSs), forums, e-mail, and prerecorded lectures. Asynchronous communication is very different from face-to-face communication and allows learners to exchange data and views in their own time and space. Students may or may not have access remotely to Web-based course material. E-mail was originally designed for supporting asynchronous communication. This type of collaboration offers some advantages. Firstly, learners are not pressed to react in a short period of time and, secondly, they can organize their messages by “branching” them around themes [5]. Problems for asynchronous communication will be raised when we expect two or more group members coming from different countries or having different background knowledge and/or who have not previously worked together to work on a common task electronically [6]. Additionally, feelings of isolation are usually common for students who participate in asynchronous communication, causing motivation reduction for learning. Students do not receive instant feedback from their questions and cannot talk in real time about results obtained in the learning activities [7].

Videoconferencing as a synchronous communication tool

Simultaneous collaboration mainly uses the Internet for communication with participants as if they were in the same room. The main tool used for the implementation of synchronous (simultaneous) communication is videoconferencing (Fig. 2). With this technology, two or more people at different locations can see and hear each other at the same time, sometimes even sharing computer applications for collaboration. A complete videoconferencing system provides two-way (send and receive) communications using the following media:

1. Video
   (a) Inputs from TV camera, document camera, cable TV, VCR, streaming video
   (b) Outputs to TV monitor, color projector, PC monitor
2. Voice
   (a) Inputs from microphone, VCR
   (b) Outputs to speakers, headphones and interpretation
3. Data
   (a) Inputs from keyboard, PC hard drives, network
   (b) Outputs to PC monitor, printer, local/network hard drives

Fig. 1 Group interactions depending on time and space

<table>
<thead>
<tr>
<th></th>
<th>Same Time</th>
<th>Different Times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same Place</td>
<td>Face-to-face interaction</td>
<td>Asynchronous interaction</td>
</tr>
<tr>
<td>Different Place</td>
<td>Synchronous distributed interaction</td>
<td>Asynchronous distributed interaction</td>
</tr>
</tbody>
</table>

Fig. 2 Example of a videoconferencing room
4. Telematics

(a) Inputs from keyboard commands
(b) Outputs to remote camera control, etc.

Some of the advantages of videoconferencing are that:

- It allows immediate, real-time interaction and promotes collaborative learning.
- It allows all participants to see and hear each other.
- It can display pictures, graphs, maps, small objects, etc. or play a video tape.
- It can demonstrate a piece of equipment or technique.
- With desktop systems you can share computer files and work collaboratively.

But also there are disadvantages, such as:

- A specialist is needed for the equipment.
- It needs a high level of instructor planning.
- It restricts room layout, instructor movement, and student seating.

The most significant distinction among videoconferencing systems is the method of transmission. Transmission is important because two systems cannot connect if they are using different transmission methods.

The more popular transmission methods are:

- H.320—narrowband over ISDN (digital telephone circuits)
- H.323—narrowband over IP networks, developed since 1996

Videoconferencing over ISDN is widely used in all domains, whereas in 2004 IP became the most common network used for hosting videoconference calls (Fig. 3).

Learning management systems

The dominant learning technology employed today is a type of system that organizes and delivers online courses. The basic unit of organization of distributed resources and other kinds of offerings in academic institutions everywhere is the course.

LMSs provide an infrastructure platform through which learning content is delivered and managed. Content management becomes a main issue for all teachers involved in VLEs, and it has been adopted by numerous universities to enable teachers to have a flexible VLE to deliver online quizzes or courses in addition to standard classes.

Most students are familiar with Web-based tools, which are attractive alternatives for collecting information, and university teachers are increasingly encouraged to use e-learning techniques to enrich the educational experience and to expand the learning environments available to students. Students construct and show their knowledge using the media with which they feel most comfortable [8]. Thus, students can learn through the VLSs in a practical way and become aware of physical phenomena that are difficult to explain from a theoretical point of view. Their role as learning mediators is essential to improve the educational experience. These mediators are especially useful in the field of science education, where the lecture material comes from predetermined texts, giving students little incentive to attend and participate in class. In the laboratory sessions, students are lost as they struggle to combine technical and scientific concepts and principles, which tend to be incomprehensible, or detached from real-world contexts. As a result, students do not have the opportunity to critically think through the issues and arguments presented in class. Consequently, students have the feeling that the most important step in mastering the material is memorizing large amounts of scientific information from chunks of seemingly unrelated examples [9].

The LMS takes learning content and organizes it in a standard way, as a course divided into modules and lessons, supported with quizzes, tests, and discussions, and in many systems today, integrated into the institution’s student information system.

Typically, an LMS is Internet-based software that supports mainly four distinguished capabilities important for teaching and learning:

1. Deliver content (HTML pages, PDF files, video lectures, PowerPoint presentations, embedded animations or simulations, etc.)
2. Communication between learners and learners and/or learners and teachers (synchronous and asynchronous communication)
3. Assessment (online quizzes, assignments)
4. Manages, records, tracks, and reports on the interaction between the learner and the content, and the learner and the instructor.

Course management systems (CMSs)/LMS include applications such as Blackboard and Moodle that create a shell in which instructors can organize the content of the instruction. These CMS/LMS applications can be quite robust.

![Fig. 3 ISDN to IP transition for group video calls. (Data from Wainhouse Research)](image-url)
by integrating with many different types of applications, including virtual worlds, simulations, assessment engines, competency management tools, content repositories, reporting services, discussion boards, classroom management tools, intelligent tutoring systems, performance support systems, knowledge management systems, and document management systems. Many LMSs provide extensibility interfaces.

Specifically, these management systems provide a means of organizing supported learning environments by allowing instructors to automate and provide information on selective portions of course materials, such as online learning modules and simulations. Additionally, they record the time that the students spend in an online quiz, the number of students viewing a course, and other useful statistical data [9–12]. Thus, by using an LMS, students have access to the educational material whenever and wherever they want and teachers can track the time that students spend viewing online course material and in online quizzes.

Additionally, from a pedagogical point of view, teachers have the opportunity to create online learning communities, where students and teachers can participate actively in the learning process and collaborate in groups. These collaborative activities often promote metacognitive processes such as reflection, self-explanation, self-regulation, problem solving strategies, and validation [13, 14]. This platform increases the student–faculty contact time since a student is in contact with his peers and with the learning subjects for more time using both asynchronous (forums) and synchronous (chats) tools.

**Implementation of learning management systems**

Moodle (Fig. 4), originally an acronym for Modular Object-Oriented Dynamic Learning Environment, is a free, open source software platform for the implementation of a CMS designed using sound pedagogical principles, to help educators create effective online learning communities. You can download it (from http://www.moodle.org) and use it on any computer you have handy (including Web hosts), and it can scale from a single-teacher site to a 50,000-student university. Martin Dougiamas, a WebCT administrator at Curtin University, in Perth, Western Australia, was the original creator of Moodle.

Moodle tools focus on:

- Content delivery for course information
- Intended use being for group work, collaboration, communication, sharing, activities, and critical reflection, a collaborative type of learning
- Being open source (free)
- Everyone actually being able to participate in Moodle development

The Blackboard Learning System (Fig. 5) or WebCT (Course Tools), acquired by Blackboard, is another platform which allows instructors to post course information and course materials, readings, and assignments and

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**Fig. 4 Moodle initial interface**

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provides functionality for basic discussion and other collaborative tools (from Blackboard). It is:

- Designed for teacher-directed/centered delivery of content
- Especially geared for lower-level courses, large classes
- Proprietary, and has a vast user base
- Based on a licensing fee

These two systems are on the same level with a large number of similarities; but there are also some key differences, as presented in Tables 1 and 2.

**Table 1** Similarities between moodle and blackboard

<table>
<thead>
<tr>
<th>Feature</th>
<th>Moodle</th>
<th>Blackboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student enrollment in courses</td>
<td>Monitoring student participation</td>
<td></td>
</tr>
<tr>
<td>Restricted access</td>
<td>Drop box</td>
<td></td>
</tr>
<tr>
<td>Customization</td>
<td>Course calendar</td>
<td></td>
</tr>
<tr>
<td>Uploading files (e.g., Word documents, PowerPoint, audio files)</td>
<td>Grades</td>
<td></td>
</tr>
<tr>
<td>Linking to external Web sites</td>
<td>Quizzes, tests</td>
<td></td>
</tr>
<tr>
<td>Zip course and provide on CD to students</td>
<td>Copy course over from semester</td>
<td></td>
</tr>
<tr>
<td>Discussion forum</td>
<td>Customized template</td>
<td></td>
</tr>
<tr>
<td>Synchronous chat</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2** Differences in key features of moodle and blackboard

<table>
<thead>
<tr>
<th>Feature</th>
<th>Moodle</th>
<th>Blackboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>All features work on dial-up</td>
<td>Bandwidth hog, may time out</td>
</tr>
<tr>
<td>Learning curve</td>
<td>Can use without manual or training. Provides excellent, easy-to-use “help” Web site</td>
<td>Not as intuitive, many components need to be configured initially. “Help” Web site complicated</td>
</tr>
<tr>
<td>Discussion</td>
<td>Photos, nested threads</td>
<td>See posts at one time, not nested</td>
</tr>
<tr>
<td>Tools</td>
<td>Blog, wiki, journal, glossary, workshop</td>
<td>Whiteboard</td>
</tr>
<tr>
<td>Cost</td>
<td>Free</td>
<td>Fee</td>
</tr>
<tr>
<td>Customization</td>
<td>Open source, so can change locally</td>
<td>Need to request change from WebCT (may not happen)</td>
</tr>
<tr>
<td>User statistics</td>
<td>Chart comparing students; number of visits per page</td>
<td>Time student spent on each page</td>
</tr>
</tbody>
</table>

**Summary**

We assert in this paper that e-learning platforms have come of age. They are not only well accepted, but they also are
affordable, easy to use, and are becoming expected, especially by students who have grown up immersed in the flexibility of digital media—the digital native generation. Financial difficulties and the emergence of new technologies have impelled universities to create new systems for delivering education in science. Technology can enable and facilitate the communication and transmission of information, providing students with the opportunity to exchange knowledge and resources and develop mutual understanding. In a computer cluster the teacher has face-to-face interactions with the students, whereas VLEs such as Blackboard and Moodle support communication components that enable both asynchronous and synchronous information exchange and online discussion. These platforms allow the management of content, students, and teachers and offer a large variety of resources and activities, such as quizzes and workshops. In both cases, the teacher can manage a high number of learners, reduce the laboratory cost, give students time to process any new information by making connections with their previous knowledge, and improve student performance in collaborative situations.

References

2. Lu L-C, Yeh C-L (2008) Int J Distance Educ Technol 6(3):85–95

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