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## The evaluation of alternate learning systems in an industrial engineering course: Asynchronous, synchronous and classroom

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### Abstract

Web-based asynchronous learning systems have revolutionized the learning environment. Rapid advances in computer technology, the internet and transmission technology have created new opportunities for delivering instruction. It is anticipated that these technologies will dramatically change the way instruction will be imparted throughout the educational system. One example is asynchronous learning wherein instruction can be delivered at any place at any time on demand. If we are to use this new mode of delivering and receiving instruction, we need to fully understand its advantages and limitations to existing forms of delivering instruction. In response to this need, this paper describes a study conducted to evaluate the usefulness of delivering instruction asynchronously. The study compared three forms of instruction: classroom, synchronous and asynchronous using student subjects from an industrial engineering course. Even though the results of this study are specific to the industrial engineering course considered, the results could throw new light into the usefulness of the Internet and asynchronous learning in other learning environments.

### Relevance to industry

This paper evaluates the usefulness of advanced learning systems in delivering instructions in an academic environment for a specific industrial engineering course. The results of this study could be further expanded to develop distance-learning programs.

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## 1. Introduction

Traditionally, learning and teaching have been built around the classroom environment with an instructor, using tools like a chalkboard and print material such as books, teaching students who meet at the same place and at the same time, that is synchronously. However, as computer technology has become more accessible and cost-effective, various attempts have been made to integrate it into educational environments. The invention of the internet and, more importantly, of the World Wide Web (WWW), a wide-area hypermedia information retrieval project begun in 1989 by Tim Berners-Lee at the CERN European Laboratory for particle physics (Berners-Lee, 1994), has contributed to this new age of electronic education, offering a wide range of options for communication and the exchange of information. By merging the techniques of information retrieval and hypertext to make an easy-to-use and powerful global information system, it offers millions of pages of information, forming a system of world-wide references.

The statistics about the Web and its users are nothing short of overwhelming. In addition to allowing immediate access to the latest version of a document (Ibrahim and Franklin, 1995), the WWW also allows students great access that is more rapid to broader arrays of more up-to-date information than a traditional university library; affords them more input in their learning process, making education more pro-active; and allows a more individual approach to assessment and learning than is traditionally possible (Sloane, 1997). The implications of such changes are revolutionary, affecting the quality of instruction, its content and its presentation, to name a few. Among the changes is the fact that a student or a group of students may never have to set foot on campus; rather, they can fulfill all the course requirements using the computer and the WWW, never meeting synchronously to listen to the instructor teaching the courses. In addition to facilitating asynchronous learning, it should be noted that the Web can also be used to support synchronous courses or meeting.

Thus, internet technology, and in this case the WWW system, has the potential to create a distance education environment which can exist beyond the traditional boundaries of a particular location to a broad range of students, involving them in highly interactive participation. Today, a student taking an on-campus course may never sit in a classroom; distance students may take a course concurrently with on-campus students, and course instructors may find themselves conducting office hours via electronic means.

As Evans and Murray (1996) found, these asynchronous (different place, different time) distance courses could be successful, with students interacting through an electronic network such as e-mail. These Asynchronous Learning Networks (ALNs), defined as networks for anytime-anywhere learning, combine self-study with substantial, rapid asynchronous interactivity with others. In an ALN environment learners use computers and communications technology to work with remote learning resources, including coaches and other learners, without having to be online at the same time, with the most common ALN communication tool being the World Wide Web. As the empirical study conducted by Boaz and Nath (1997) found, using e-mail, the Web and bulletin boards as tools in ALNs achieved the educational goals of completing homework quickly, improving class performance, increasing productivity in class, enhancing learning and increasing the communication with instructor and peers in an environment appreciated by the students.

To supplement academic performance and increase the power of ALNs, specialists have experimented with various presentation styles and multimedia components, making sure such educational environments are in accordance with new theories of communication systems; consistent with instructive philosophy and styles of teaching; convenient, accessible and relevant to the students; and finally, well-organized and well-presented (Barreau et al., 1994). However, it should be noted that, even though asynchronous learning has been part of the educational lexicon for many years in the form of "individual study," it is the mode of technology that has revolutionized the teaching methods.

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