

Just-in-Time Learning: Web-Based/Internet Delivered Instruction

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Introduction

According to The National Education Association Research Division (1994), student acquisition of higher order thinking skills is of national critical concern. Increasingly, educational leaders are recognizing that the learning process is of critical importance and understanding the way individuals learn is the key to improving the educational system. There is substantial research which indicates that the educational establishment in the United States is comparatively behind that of selected European and Asian nations in teaching students to compete in highly technical environments. In order to remain economically competitive in an environment where technology is changing rapidly, employees need to be problem-solvers and creative thinkers. Educators must prepare students for this environment by focusing on higher order cognitive skills, the skills which foster the development of problem-solving and creative skills.

The focus of this paper is to demonstrate how the use of advanced technologies in the classroom facilitate teaching effectiveness and student development of these higher order cognitive skills. Use of technology in course design allows flexibility, adaptation, and "just-in-time" delivery of course material. Just-in-time delivery allows the capability to uniquely customize course material in a matter of moments. The power of this method of delivery includes the capability to present time or reference sensitive information, to allow criss-crossing of knowledge, and to present the most current and up-to-date information available.

Background

Just-in-time is a concept most often associated with the manufacturing and production sector. In the manufacturing and production sector, just-in-time manufacturing provides mechanisms for automated delivery of information that can be set at predetermined intervals. This insures that employees have the latest information. Companies can also implement selective broadcasting to targeted users. Preferences of users can also be specified to personalize users needs. These mechanisms help to transform corporate networks from passive data stores to active information disseminators. Critical business information can be provided to knowledge workers and decision makers frequently.

Because of the success of just-in-time principles in the manufacturing and production sectors, the ideas have been applied to varied and diverse applications such as

leadership training, health care services, consulting services, financial analysis, market analysis, stock predictions, and dispatching. Just in time principles can just as readily be applied to the production of quality education. Application of just-in-time principles to education requires that faculty change from the idea of standardized mass production to just-in-time learning. The new paradigm become a dynamic, interactive environment where students are active learners. They construct knowledge and understanding in situations by using problem solving and decision-making skills.

Issues

Many inefficiencies and waste exist in the traditional learning environment (Thomson, 1994). The current academic system of courses, credits, and evaluation methods is increasingly ill-designed to meet students needs. Courses often consist of large blocks of content, students often only need small parts of that content, and they are increasingly able to get what they need from other sources. Much of the content used in the classroom is outdated and obsolete.

Another problem in the traditional classroom environment is that all students are not created equally. Students enter a classroom with varying degrees of ability, experience and background as well as different career goals. Because students have a wide range of capabilities and past experiences, the playing field is not even on the first day of class. This is especially true in technology courses where range of students' capabilities run from students who have never touched a mouse to students who are professionally certified in technological areas. The teacher is forced to satisfice for the class as a whole and to sacrifice learning activity for the individual.

Students learn at different rates and in different ways. Educators must be prepared to address various levels of cognition and engage students at many levels of cognition in order to maximize learning. Howard Gardner [1991] of Harvard says that differences in learning styles "challenge an educational system that assumes that everyone can learn the same materials in the same way." For some students the most effective method of learning is by seeing and hearing. For others, reflecting and acting or reasoning logically and intuitively are more effective methods.

In a traditional classroom environment, all course information is tied to one source. The professor decides on the curriculum, content, resources, learning environment, and evaluation methods. Many students find

this conventional instructional material uninteresting because it is highly textual or symbolic, passive, linear, centered on memorizing data, and remote from issues that learners can identify with. Many traditional classroom environments are conducted using this didactic philosophy. The teacher is the primary source of knowledge and wisdom and passes the knowledge from teacher to student [Bagley & Hunter, 1992].

What is needed is a strategy that suggests changes in the curriculum as well as effective uses of technology as a strategic part of change. Just-In-Time principles include rapid response to changes in markets or technology, the elimination of waste, striving for continued improvement, and employee involvement. Just-In-Time requires that every phase of current processes be reexamined, rationalized, and reengineered in order to respond quickly to customer needs. These just-in-time principles applied to instructional design can produce classroom instructional design which meets the immediate needs of learners. Just in time techniques can use technology to integrate teaching pedagogy with appropriate technology and techniques to achieve higher order cognitive skills.

Solutions

Current theory favors a constructivist perspective (Forman & Pufall, 1988; Newman, Griffin, and Cole, 1989; Piaget, 1973; Resnick, 1989; Vygotsky, 1978). Constructivists view learning as the active engagement of learners in the construction of their own knowledge and understanding of facts, processes, and concepts. This learning occurs through interaction. Learning becomes a dynamic process, not just the acquisition of facts. It naturally follows that teaching should involve less autocracy and be more supportive. Educational practices that follow from this focus are designed to facilitate students learning by nurturing cognitive skills. The idea is to create a supportive environment, one in which students can create their own ideas, both individually and collaboratively. It has been suggested that teachers and students should actively experiment, discover, and create in the classroom. The characteristics of this learner-centered approach are that it is flexible and activity-based.

Web-based/internet based instruction can provide the vehicle for a new era of classroom instructional design. Web based courses offer a new approach of looking at instructional design through organization and structure. Figure 1 contrasts differences between the traditional classroom environment and web-based internet instruction.

restricted to physical space.	according to strategy
Static delivery schedule	Flexible delivery schedule on an a just in time basis
Assumes a homogeneous audience	Unique and varied audience characteristics accommodated
Emphasis on instructor control	Emphasis on learner control
Training is broad-based and linear	Training is designed to be specific, modular, and flexible
Paper intensive	Paperless environment
Passive learning	Active learning
Content oriented	Activity based

Figure 1.

Using new media requires new approaches to teaching. Deciding what course content to put online is more than a matter of converting content to HTML and publishing it on a server. There are important considerations on what should and shouldn't be placed online and which tools work best to reach instructional goals. Most efforts to create computer-supported collaborative learning environments have been focused on students. However, without providing appropriate integration of collaborative activities into instructional design, the effort will have little impact on educational practices. Technological tools are beginning to be viewed as means by which students can be actively engaged in the responsibility of learning when working individually, in pairs, or as part of cooperative groups. To improve education through technology, learning environments for students must be integrated with curriculum tools in order for teachers to be able to create an integrated collaboration-oriented classroom.

Tools

Specific technologies support and relate to the learning of specific higher order cognitive skills. For example, the following examples relate specific technological components to the development of specific skill-development. The following components can be embedded easily in web-based curriculums.

Virtual Conferencing: Electronic delivery is more efficient than physically moving people. Virtual conferencing is a synchronous environment meaning that it provides a medium in which information can be delivered by many sources simultaneously and instantly. Virtual Conferencing may include technological features ranging from a real time chat environment to full video/audio conferencing. Virtual conferencing has three basic purposes: To teach collaborative learning techniques, to develop teamwork skills, and to provide

Traditional Classroom	JIT Learning - Web based/Internet Instruction
Didactic philosophy	Constructivist philosophy
Audience size is	Audience size is unlimited

various levels of communication interaction. Virtual conferences encourage higher order learning skills through an interactive environment. The dynamic environment requires active participation by the users and enhances personal communication. Virtual conferencing is also flexible. Participants can participate from any origination site in the world which has internet connections. Experts from academia, business and industry can join the class in a completely interactive virtual environment.

Threaded Discussion: Threaded discussions refer to a "conversation" conducted online on the Internet by a group of individuals over a period of time on a specific topic. Threaded discussions are conducted asynchronously which means that participants are not communicating simultaneously. Threaded discussion lines provide access for group communications. Groups can post their needs, problems, or ideas for discussion and members of all groups can respond and contribute. The nature of the system enables students to prepare very thoughtful responses, therefore the quality of information can be very high. The availability of an archived transcript of the class allows review of previous comments and discussion prior to having to provide an answer. Writing and critical thinking ability increases. Quality of content overrides personality or charisma. Faculty are able to provide significant one-to-one instruction to students when they need it or within short periods of time. As a medium, it is particularly conducive to brainstorming, networking, group synergy, and sharing information.

Electronic Resource Repository: An electronic resource repository is a centralized repository to which individuals or groups can post resources, sites, or references which may also be beneficial to other groups. In knowledge repositories, knowledge is developed, secured, and distributed. The goal of encouraging groups of learners to engage collaboratively in problem-solving activities also requires social interaction which encourages deep learning. Students can then develop intellectual structures that allow them to create their own knowledge. For the Internet repository to work as a collaborative medium, students and teachers who benefit from the repository have to participate in its growth and evolution. They need tools that make it natural and easy to contribute new versions of activities and curriculum and to reference repository offerings they have used with their experiences.

Electronic Proceedings: Students need appropriate feedback on performance to succeed in courses. Students need frequent opportunities to perform and receive suggestions for improvement. In getting started, students need help in assessing existing knowledge and competence. All "A" level work can be archived and posted to the web as an example for students to model.

Students need chances to reflect on what they have learned, what they still need to know, and how to assess themselves. Students need the opportunity to show their talents and learn in ways that work for them. Then they can be encouraged to learn in new ways.

Electronic Administration Tools: Many administration tools can be included within a web-based/internet delivered environment. Course syllabi, course calendars, and University policies can be included in order to facilitate easy access for students. Interactive databases provide a mechanism for students to access grade reports, comments, or course progress. Information can be disseminated quickly and globally to all students. The ability to quickly disseminate information allows for a high level of flexibility in the material that can be provided. Electronic administrative tools allows students to efficiently use resources independently and empowers students with individual responsibility for course materials and assignments.

Conclusion

Developments in technology will make it increasingly less costly and time intensive to include electronic tools in web-based/internet delivered courses. Existing and new technologies will continue to be creatively applied to achieve instructional goals. Innovations will occur including new uses for the World Wide Web, listservs, and audio-video conferencing tools. Computer tools will become "smart" and have more "intelligent" capabilities. These tools will help us filter and access the information we need. Students will be responsible for demonstrating understanding, not just memorizing ideas. In order to do so, teachers will need to become creative and adventurous in their teaching and classroom management. Just-in-time learning applies tried and true principles from the manufacturing field to the development of quality education and provides the methodology to integrate technological tools with strategic instructional design goals.

References available upon request from Laura L. Hall.