

8-15-1997

Three Instructional Principles Applied To Computer-Based Learning (CBL) In Subjects With Large Enrolments

Vanessa Chang
Curtin University of Technology

John Palmer
Curtin University of Technology

Follow this and additional works at: <http://aisel.aisnet.org/amcis1997>

Recommended Citation

Chang, Vanessa and Palmer, John, "Three Instructional Principles Applied To Computer-Based Learning (CBL) In Subjects With Large Enrolments" (1997). *AMCIS 1997 Proceedings*. 311.
<http://aisel.aisnet.org/amcis1997/311>

This material is brought to you by the Americas Conference on Information Systems (AMCIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in AMCIS 1997 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

Three Instructional Principles Applied To Computer-Based Learning (CBL) In Subjects With Large Enrolments

Vanessa Chang, John Palmer

School of Information Systems, Curtin Business School
Curtin University of Technology
Perth, Western Australia.

Abstract

The rationale for choosing computer-based learning and three instructional principles (mastery learning, overlearning and automaticity, and pre-requisite knowledge and skills) needed for the introduction of Computer-Based Learning (CBL) in an introductory Information Systems subject with a large enrollment are described in this paper. This paper concludes with a summary of a study conducted in 1993 and 1994 on the use of CBL in a first year Information Systems unit offered by the School of Information Systems, Curtin University of Technology, Perth, Western Australia.

Information Technology In Higher Education

Over the last decade, computer technology has been used to improve the effectiveness and efficiency of the educational administrative system and also to complement traditional teaching. With the increase in computing power and the decrease in the cost of hardware, the use of the computer to deliver instruction has become increasingly prevalent in today's educational system. Many institutions see great opportunities in the application of this technology in education and learning.

In using the computer to enhance teaching and learning, a theoretical or educational framework must exist to support computer-based education. Three instructional principles of Mastery Learning, Overlearning and Automaticity, and Pre-requisite Knowledge and Skills related to the use of computer-based technology in the first year Information Systems unit at the School of Information Systems, Curtin University of Technology, Perth, Western Australia are discussed in the following sections. This paper is based on the author's Masters thesis which addresses several research questions covering organizational, design and academic factors contributing to students' perceptions of the effectiveness of Computer-Based Learning technologies (Chang, 1996).

The Information Systems Unit

The annual enrollment for the unit, Information Systems 100 (IS100) is approximately 1400 students. It is a compulsory unit for all first year Bachelor of Commerce students studying at Curtin University of Technology.

There is no pre-requisite for the unit and partial exemption is not permitted.

The majority of the students who enrol in this unit are high school graduates. There are also mature age students who already have computing work experience and also those who have an inherent fear of using a computer. Hence, the level of students' computing knowledge varies from computer fearful to computer illiterate to computer literate. The volume of students and the varying levels of their computing background and skills were recognised as major potential problems in this unit. These concerns led the School of Information Systems to consider the integration of computers as a teaching and learning tool as an integral part of the unit curriculum.

The instructional principles of Mastery Learning, Overlearning and Automaticity, and Pre-requisite and Skills were used as a guide to develop the CBL modules for this unit. The CBL program supplemented the lectures in IS100 in accordance with these principles.

Instructional Principle 1: Mastery Learning

The concept of *Mastery Learning* (Bloom, 1971) is derived from Carroll's (1963) model of school learning which relates to *time needed in learning*, which depends on student's aptitude and ability to understand instruction and *time spent in learning*, which depends on the time allowed for learning. Bloom (1971) states that mastery learning requires a student to demonstrate a specific skill before proceeding to another skill or set of skills.

Chandler in Lillie et al (1989) states that when students were taught with mastery learning techniques, they demonstrated greater gains in achievement than when they were taught with traditional (ie classroom learning) instruction. The reason is that in classroom teaching and learning, the instruction time is constant and achievement varies within a group.

The instructional principle of *Mastery Learning* states that "*given enough time and help, about 95% of the learners in any group can come to a complete mastery of the designated instructional objectives*" (Vockell, 1990:11).

Since the target achievement level amongst all the students is constant, some students may require extra help and may take longer to master an objective and others may learn an objective within a shorter timeframe.

Mastery Learning: Applied to CBL

The CBL courseware in IS100 aims to provide an opportunity for students to work through the program at their own pace. By using this courseware, the students are 'active' learners where they would have greater control over the program and hence responsibility for their own learning. Also, with the '*one-on-one*' system, students are free to explore all areas from beginning to advanced topics.

Instructional Principle 2: Overlearning and Automaticity

The instructional principle of *Overlearning and Automaticity* states that "*with many skills and concepts, it is important to continue studying them and applying them well beyond the point of initial mastery*" (Vockell, 1990:12).

As we have seen in mastery learning, some students master objectives quickly, a large number of them learn at a medium rate, and others learn very slowly. Because of the way traditional class time must be structured, the instructor is forced to move on to the next concept or topic as soon as the instructor has covered the topic sufficiently in accordance with his or her standard. This may mean that the middle group of students has some understanding of the topic and may need to do additional reading in order to gain a thorough understanding of the topic. The students who get the most from this type of teaching are the brightest students but it is the slowest students who need '*overlearning*' the most (Vockell, 1990; Vockell and Schwartz, 1988). The slowest students in this case are the most disadvantaged, as basic skills and concepts must be learned to a point where they become '*automatic*', so that they can be used to handle higher level objectives or the next corresponding topic (Vockell, 1990).

Overlearning and Automaticity: Applied to CBL

In IS100, the CBL courseware program is designed to include basic skills training so that the students can learn the skills on their own. The self-paced instruction encourages students to take the most efficient path to achieve mastery of the basic concepts. Students who are fast learners can go through the basic concepts, rules, or principles very quickly. Since the courseware is delivered in a consistently reliable manner in that it does not vary in quality from class to class, slower students can remediate where they are having problems and go through those areas several times in order to get a good understanding of the topic.

Instructional Principle 3: Pre-requisite Knowledge and Skills

The instructional principle of *Pre-requisite Knowledge and Skills* states that, "*knowledge is often hierarchical, and frequently the best way to assure performance on higher-level objectives is to identify the prerequisite skills needed for a current unit of instruction and ascertain that students have mastered them*" (Vockell, 1990:13).

The main reason students have difficulty understanding and remembering new content or skills is because they lack the prerequisite knowledge. According to learning theory, acquiring and using new knowledge is greatly affected by the existing knowledge which students bring to a learning situation (Johnson and Thomas, 1992). The knowledge students have when entering a classroom is used to interpret and understand what is presented each day. Computers can be used to assess students' knowledge and skills in a particular topic and to deliver instructions to students who do not have the necessary skills and concepts (Vockell, 1990; Johnson & Thomas, 1992).

Pre-requisite Knowledge and Skills: Applied to CBL

IS100 is a unit that requires no pre-requisites, and advanced standing for part of the unit is not given to students. Exemptions are given to students who can prove that they have passed a similar unit covering the same tertiary level syllabus at other institutions and to those with substantial work experience involving information systems and information technology.

By using the CBL courseware, students are able to identify for themselves the skill areas which are needed for a particular objective or topic. This is especially useful for advanced learners as they can work through the courseware quickly and concentrate on areas in which they need to improve.

The CBL Courseware

The CBL modules designed for IS100 were not meant to replace the traditional methods of classroom teaching but to complement it through self-paced learning. Eight CBL modules were developed for the unit. The topics chosen for the CBL modules contain concepts which are academically stable and the subject content for the topics can also be easily represented using CBL. The CBL modules were equipped with hypertext, graphics, animations, colours and buttons.

The same "*look-and-feel*" standard or "house-style" was used to maintain the continuity of all the modules. The students did not have to go through each module in a structured fashion or by linear progression. They could move around the module and study topics which were new to them.

If students chose to break out of the linear progression and then found that the material they had chosen was too advanced for them, they could choose the "Go Back" button which would take them back to where they were before they chose to divert from the linear progression. The students could also choose "Help" to check their location within the module. Also, at any time during use, students could activate the "Quiz" button to go through all or some of the multiple choice questions. For each question that students answer correctly, they received a message to continue on in "Quiz". If the answer was incorrect, students could go back to review the material specifically relating to the question or continue on in "Quiz".

Summary

A study conducted in 1993 and 1994 found that in this system of individualised learning, the students have a greater amount of flexibility in setting schedules and thus approved of the self-paced learning where they can study the modules independently. The study also revealed that the students prefer CBL as a supplement rather than as a substitute for classroom teaching.

According to the study, many students perceived that CBL is more effective when it is incorporated with test questions as this provides them with a guide to their learning. The study also revealed that the majority of students who used the CBL modules for revision found the modules helped them in their learning.

The study found the CBL modules provided access to students who lack the foundational knowledge needed for continued learning. The study also found that CBL is a relevant and appropriate tool for mastery learning in IS100 where students can study the basic concepts, rules and principles through CBL. The 'overlearning' process provides a strong reinforcement of the concepts being taught and significantly increases content retention over time. When the CBL modules were used as such, it achieved the theoretical concepts of mastery learning, automaticity and overlearning, and pre-requisite knowledge and skills.

The above findings were significant in that they led to the continued development on the Curtin campus of multimedia presentations for use in large units.

References

Bloom, B.S. (1971) Mastery Learning In Block J H (Ed.) Mastery Learning: Theory and Practice. New York: Holt, Reinhart & Winston.

Carroll, J.B. (1963) A Model of School Learning Teacher College Record, 64:723-733.

Chang, V. (1996) A Study of Student Perception of the Effectiveness of Computer-Based Learning Technology in an Information Systems Unit, Masters Thesis, Curtin University of Technology, Perth Australia.

Johnson, S.D. and Thomas, R. (1992) Technology Education and the Cognitive Revolution. The Technology Teacher, January:7-12.

Lillie, D.L., Hannum, W.H. and Stuch, G.B. (1989) Computers and Effective Instruction. Using Computers and Software in the Classroom. University of North Carolina, Chapel Hill. Longman, New York.

Vockell, E. L. (1990) Instructional Principles Behind Computer Use. The Computing Teacher, Aug/Sept:10-15.

Vockell, E. L. and Schwartz, E. (1988) The Computer in the Classroom. Santa Cruz, CA: Mitchell Publishing Company.