An Introduction to Computer Based Instruction

There are a variety of terms used to describe the educational use of computer and each has a slightly different meaning. Computer Assisted Learning (CAL) is an all encompassing term to describe any educational use of computers. Such uses can be divided into three main groups: (1) when the computer is used as a tool (word processor, data base, spread sheet, and graphics application); (2) when the student 'teaches' the computer, for example, by issuing a set of instructions to the computer through a programming language such as Logo, and (3) when the computer delivers some instructional material (Taylor 1980). This latter situation is termed Computer Based Instruction (CBI) or Computer Assisted Instruction (CAL) which is an older term than CBI. This paper will only deal with the third aspect of the use of computers in education, computer based instruction.

Computer Based Instruction has traditionally been composed of four main components, Drill and Practice, Tutorials, Games and Simulation and Modeling. Modern technologies have added to these Hypertext, Hypermedia and Multimedia. These new technologies will be deal with in detail later in the paper.

Drill and Practice was probably the most extensively used CBI application in the early days of the educational use of computers. It can be argued that there were two main reasons for this; (1) they were comparatively easy to program, which was important as there was little available commercial software and so teachers who wished to use computers had often to write much of the software themselves; (2) the programs could show off effectively the capabilities of the computer and this was important for the computer-enthusiast teacher as it could help to win over colleagues to the cause, and hopefully, result in more money being spent on computers in schools.

A drill and practice program typically deals with material that has already been taught. The student is presented with a task, often selected randomly, and feedback is offered immediately it is completed. A well constructed program of this type should be able to keep pace with the student by offering remedial or advanced level if and when they become necessary (Hannafin and Peck 1988, 4). There is a place for drill and practice mainly for the beginning learner or for students who are experiencing learning problems. Their use, however, should be kept to situations where the teacher is certain that they are the most appropriate form of instruction.

Tutorials attempt to teach new materials. Typically they present information and then question the user to ascertain the level of learning achieved. The program should be able to monitor the student's progress and to present remedial or advanced levels if and when required. The tutorial is based on the Socratean model but Merrill (Twitchell 1991, 35) cautions that "Socrates is highly over-rated. We give too much credit to tutoring as a model".

From a practical point of view, the computer tutorial is very limited in its ability to assess the level of understanding of the student. In the classroom situation, when teachers ask questions, they can assess the level of understanding of the topic, the degree of comfort with the material, etc., by not only listening to the answer given, but also by observing the speed with which it is given, the degree of hesitation, the body language of the student, and so on. The computer, however, is only capable of responding to the answer given, usually by typing characters on a keyboard. A teacher can accept a slightly wrong answer and probe deeper to get the correct one. The computer can normally only respond to a small number of possible answers and often cannot cope with a slightly incorrect answer; for example, if the expected answer is apples and the student enters apple, the computer will frequently reject it which can result in a considerable degree of frustration on the part of the student. There is also a problem from the designer's point of view; after a screen of information has been presented, it is difficult to determine which question will demonstrate an understanding of all the information that has been given. Research is being conducted in the production of Intelligent Tutoring Systems which should overcome this problem, but these will depend upon artificial intelligence (AI), however, some people state that the true meaning of AI is always impossible.

Educational games are normally placed in a group of their own, but in practice it is often difficult to differentiate between games, drill and practice programs or simulations. It is possible to have a game and a drill and practice program that contain the same content, but which have a different end result For example, the game Maths Invaders has the same content as a drill and practice program in that users are asked to complete a number of sums, but the outcome is different as when a question is answered correctly, as in the game the student gets to shoot down an alien. A game can also have the format of a simulation but the major difference between the two is that a simulation normally models a real life situation whereas a game can model an imaginary one. Games also have a place to play in the classroom especially as a way of increasing the motivational levels of students. However, they should be used with care. Many students, especially boys, spend a lot of time playing computerised games and it is important that the classroom computer is not seen solely as another games machine.

Simulation programs normally model some real life situation and they enable students to manipulate and experiment with it. The normal justification for using them is in situations where the real thing is too expensive, too dangerous or too time consuming. For example, students would not normally be able to observe the evolution of a species as it would take too long but the whole process could be observed in a very short period of time on a computer simulation. While simulations have a potential to be useful in the classroom, they do have some draw backs. These will be considered in more detail later.

COMPUTER-BASED INSTRUCTION

Recently, I took a course in how to design an on-line classroom--one in which all communication between teacher and student occurs via the World Wide Web. Each of the class members designed a course (in my case it was on nursing) that was critiqued by peers, all of whom represented different disciplines; participated in synchronized (Web chat) and asynchronous (discussion forum) instruction; established on-line assignments and course resources; and created a Web or menu page.

My course was for postsecondary teachers, but it is clear that middle and high school teachers, counselors, and administrators are soon going to need the same type of training. According to Bicanich et al. (1997), 18,000 school districts in the United States are working to incorporate Internet capability into their classrooms and curricula. New ways of thinking and communication will be called for, as students become active participants in the learning process, both on an individual basis and as members of learning groups. Based on my experience, I offer eight guidelines for educators who will be using and supporting computer-based instruction:

1. Check the criteria and regulations of an accreditation agency for electronically offered programs. At my institution, I follow the Southern Association of Colleges and Schools

(SACS) regulations. Also, check specific program guidelines. For me that means the guidelines of the American Association of Colleges and Schools (for B.S.N. programs) and the National League for Nursing, our accrediting agency. Ask yourself, How will the technology help my school meet the educational performance standards established by the state?

2. Identify resources already at your school--for example, computer equipment, Internet connections, software and telecommunications capability; space and time allocations; staff trained and experienced in the use of the equipment; in-service training; maintenance contracts; and the capacity of the school's electrical system to handle an increased demand. At this point, also consider privacy and security regulations. Will each student have his or her own computer access code? How will students' work and testing be safeguarded?
3. Orient students to the Internet. Give them an overview of the computer's basic hardware and software operations. Demonstrate how they can access databases, use E-mail, perform word processing, and work with graphics or simulation models (especially if a lab is involved) and with various types of programs.
4. Have each student select an "E-mail pal" with whom he or she shares common interests. The computer pal may be in the same class, a different class or grade, or a different school altogether. Once students master E-mail, have them send information back and forth using E-mail file attachments.
5. Use Web links to locate other learning sites on the Web. Links may be found related to distance education in special topic areas such as biology, English, history, math, psychology, health, and so forth. For example, YAHOO, one of ten "search engines," provides an introductory page with links regarding education, including distance education, K-12 resources, and nearly thirty other categories. You can download materials to use with a class. If students in a business or economics class, for example, are learning about stocks, you can go to the Web site The Motley Fool at http//www.fool.com/school. There, you can establish a link to a study assignment on stocks or download the program, which in the case of The Motley Fool would be "The Thirteen Steps to Investing." (It is always a good idea to preview sites that you want students to link to.)
6. From a menu on the site, have students select a learning project that involves a cooperative learning approach. Students benefit from seeing samples of excellent work as well as others' mistakes. Critical thinking is facilitated: students learn to set clear objectives, ask sound questions, search for answers, receive immediate feedback, develop hypotheses and test them, construct well-thought-out conclusions, and write concise reports. Computer-mediated discussion of peer writing reduces students' hesitancy and encourages creativity and logical thought. Students can give specific, descriptive suggestions or revisions while articulating sound rationale and principles. That familiar form of global feedback--"looks good to me"--is eliminated. A "value added" outcome might be that the group publishes a mini news page on their individual projects' results or designs an individual portfolio of their work.

Also consider computer simulation learning. Most of the software is flexible and user friendly. Fourth-grade science students, for example, can simulate weather patterns; older biology students can examine the effects of running on the cardiovascular and respiratory systems; advanced students can design, run, and test models. Most important, feedback is immediate, with highly appealing visual displays and analyses.

7. Use computer-based testing, which can be perceived by students as less frustrating and anxiety producing than traditional test taking. In fact, testing may be perceived as a "simulation game" as students move through the problem-solving process. Students may prefer the Internet for test practice and self-assessment. Test results may be aggregated for group analysis, and test banks can be built that generate flexibility in test design.

Counselors may want to explore computer-based assessment measures and databases. For example, the program "Learning Plus" determines students' skills in mathematics, reading, and writing on the secondary and postsecondary level. The program is a complete system for learning skills and strategies that put students in charge of their own learning. Because of its reinforcement suggestions and self-correction features, the program builds learning self-confidence and problem-solving tactics. It is also multiculturally sensitive.

8. Build your own skills through instructor training programs. Many community colleges offer "how to" courses in the evening. Outline your computer-based instructional strengths and needs and create a personal learning plan. Practice accessing the Internet's Web sites with a "browser," the special software for viewing, such as Netscape or Internet Explorer. Most computer experts suggest that a beginner should practice at least one hour a day to learn basic skills quickly.

With Internet learning, students perceive teachers as guides and facilitators in the learning process rather than as instructors dispensing and controlling information. Careful planning, designing, and evaluating of computer-based learning can yield results for you and for your students beyond your (and their) wildest imaginations!

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Integrating computer-based instruction and peer tutoring. By: Smith, Rebecca G.. Intervention in School & Clinic, Sep97, Vol. 33 Issue 1, p65, 5p, 1 diagram, 1 bw;
Abstract Discusses technological integration, such as computer-based instruction (CBI), used by teachers in the diverse classrooms in the 21st century. Problems encountered by teachers and students in the process of technological integration; Details about various instructional software design for student; Information about Classwide Peer Tutoring (CWPT), instructional arrangement which facilitates CBI.; (*AN 9710055455*)
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INTEGRATING COMPUTER-BASED INSTRUCTION AND PEER TUTORING

The integration of technology into the curriculum will be a challenge for teachers in the diverse classrooms of the 21st century. Technological integration refers to the use of technology as an alternative instructional intervention to achieve specific individual, as well as classwide, goals (Edyburn, 1992; Prickett, Higgins, & Boone, 1994). Students in diverse classrooms will reap the benefits of integration, not only in becoming informed travelers on the information highway, but also by having the technological tools to enhance and extend their skills in reading, writing, and arithmetic.

Teachers are achieving technological integration by using more computer-based instruction (CBI) in their classrooms, due to the increased availability of less expensive hardware and software (Behrman, 1994; Ellsworth, 1994). CBI is defined as instruction in which the computer acts as the teacher by presenting new information or providing guided practice (Lewis, 1993). Compared to only a few years ago, when there was one computer for every 30 students, a recent study by the Office of Technology Assessment revealed an average of one computer for every 9 students (Bruder, 1993; Cooley, 1996). This promising fact makes CBI an appealing possibility as an instructional alternative.

As with any innovation in curriculum and instruction, teachers must be aware of and plan for a variety of problems and promises concerning technological integration, in particular, CBI. The following sections address some of the issues gleaned from the current and growing research base on CBI in the diverse classroom. This article describes some of the problems encountered by teachers and students in the process of technological integration, presents a discussion of promising instructional software design features, and provides an example of an instructional arrangement-Classwide Peer Tutoring (CWPT)--that facilitates CBI as an alternative intervention.

PROBLEMS: TEACHERS' NEEDS AND STUDENTS' SKILLS

The successful integration of CBI as an instructional alternative necessitates teacher training, planning, and role flexibility, and the use of an instructional arrangement to facilitate integration. Special educators need training to foster their skills in choosing and using appropriate software for CBI; however, only 2% of most school districts' technology budgets are set aside for technological inservice training (Bruder, 1993; Mevarech, Siller, & Fine, 1991). Training is needed in how to select and critique software as well as how to match software to the instructional objectives (IO) contained in a student's Individualized Education Program (IEP). For instance, specific software is designed for tutorials, drill and practice, simulations, and games (Lewis, 1993). Teachers must be able to decide which software programs are appropriate for which students.

Teachers also need time for planning computer-based lessons that focus on appropriate matches between the lessons' instructional objectives and computer software, and they need assistance in juggling the multiple tasks necessary for integrating CBI effectively into the classroom. Some of these tasks concern the teacher's role as direct instructor, learning facilitator, classroom manager, schedule maker, and general trouble-shooter.

In addition, there are student-centered concerns. For example, software programs with complex menu choices or designs that use open-ended problems are not practical for students with reading and language disabilities (Okolo, Bahr, & Rieth, 1993). Such students need more teacher-guided, learner-centered systems and a supportive social setting (Papert, 1980).

PROMISING COMPONENT: SELECTION OF INSTRUCTIONAL SOFTWARE FEATURES

Successful integration of CBI in the classroom depends on selecting appropriate instructional software with design features that foster positive learning outcomes. Promising instructional features of software for students with disabilities include (a) selection of performance goals in math skills games, (b) review of skills, and (c) direct instruction in problem-solving strategies. Additional positive outcomes indicated by research include increased time on task and better motivation. Furthermore, use of technological tools such as databases and problem-solving software has resulted in an increase in the development of higher-order thinking skills (Fuchs, Bahr, & Rieth, 1989; Mastropieri, Scruggs, & Shiah, 1991; Okolo et al., 1993). CBI is a proven and effective tool for students with disabilities at all stages of learning. For instance, tutorial and drill-and-practice software, as well as organizational and productivity tools, facilitate learning at the acquisition, fluency, maintenance, and generalization stages (Behrman, 1994; Rivera, Erin, Lock, Allen, & Resta, in press). The use of CBI complements instructional principles such as acquiring automaticity for math facts (Vockell, 1990). Sources of software information are provided in Appendix A.

After selecting appropriate instructional software, teachers need to plan for CBI integration in the classroom. This includes preparing students to assume different "teacher" roles and to work collaboratively. For example, teachers can cooperate and share work roles in the classroom with students (Lentall & Ferkis, 1993) when CBI is combined with a promising instructional arrangement such as CWPT, which is supported by an impressive research base (Greenwood, Delquadri, & Carta, 1988).

PROMISING COMPONENT: CWPT AND CBI

Peer tutoring is defined as the pairing of two students (a dyed)-one of whom is competent in a skill or procedure and one who is less competent-to enhance and extend academic instruction Mercer, 1992). Effective peer tutoring arrangements produce higher rates of academic response when compared with teacher-only mediated instruction (Greenwood et al., 1987). Several studies have demonstrated student gains in the use of thinking strategies, positive attitudes toward learning, and oral responses in classes where peer tutoring has been implemented (Beirne-Smith, 1991; Fantuzzo, King, & Heller, 1992; Starr, 1991). Integrating CBI into CWPT not only facilitates academic responding and learning, it fosters self-esteem, social development, and problem-solving skills (Light & Mevarech, 1992). Successful integration is directly related to planning, training, practice, and classroom management. The rest of this article offers a step-by-step organizational plan for integration of an adapted version of CWPT

(Greenwood et al., 1988) and CBI, using mathematics as the curricular focus and Math Blaster (Davidson & Associates, 1990) as the chosen software.

Step 1: Planning
Planning, the most essential component of integrating CBI into CWPT, involves five activity areas.

1. Teachers must determine the instructional objective(s) of the software, and if they are consistent with the curriculum and students' needs. For example, Math Blaster presents increasing skill levels in arithmetic computation. (Some of the positive design features and possible instructional objectives of Math Blaster are presented in Appendix B.)
2. Teachers need to determine if the software is compatible with available classroom hardware. For example, the computers must have the required amount of memory to run a particular piece of software.
3. Teachers must review the software manual to evaluate specific design features (e.g., amount of reasoning involved). This should be followed by a session or two at the computer to discover any potential problems with the hardware or software.
4. Teachers need to map out a plan for pairing students for CWPT. Initially, it is best to pair average-to-above-average math students with lower achievers or students with learning problems. If personality clashes occur, adjustments can be made, but dyads (CWPT pairs) need to be together for at least 4 weeks to allow students to work out problems.
5. Teachers need to prepare contracts, point sheets, and a poster illustrating tutor/tutee roles (see Appendix C) at the computer. The contracts serve two functions: helping the teacher keep track of who is paired with whom, and reminding students that their roles are serious business. Point sheets for each dyed can be stapled to cardboard and posted at each computer workstation or in a central location. In addition to indicating weekly rewards, the point sheets remind students of their partnership. Each day that student pairs work together at the computer, they may award each other 1 point by circling a number on the sheet at the end of each work session for (a) good tutoring skills (e.g., tutor praised his or her tutee), (b) completed activities within a certain time frame, and (c) agreement on and successful completion of a problem-solving activity at the conclusion of the math facts activity. The teacher also may award points when outstanding behaviors are observed. Two different colored markers can be used for circling points-one for the peer tutoring partners and one for the teacher. Students should be cautioned not to abuse the point system. A poster can serve as a visual aid to remind students of their roles and the use of the point system.

Step 2: Training and Practicing
Step 2 involves the training of tutors and practice time at the computers for pairs. During a special classroom session, the teacher should assisting their partners at the computer. Tutors can read directions, point out strategies such as "counting up" in addition, problem solve with the tutee to figure out how to play strategy games used in Math Blaster, and praise tutees for correct answers. Tutors must be cautioned not to use the keyboard or do the work for the tutee, but to watch, point out errors, and encourage and praise tutees.

The teachers should practice with tutors at the computer by modeling the tutee roles with various students. He or she should explain and/or model the use of the point sheets, rules, and tutor/tutee roles. After this is completed, the teacher can pass out contracts, explaining that these agreements are binding and important for the math business ahead. After contracts are signed and pairs are comfortable with their roles and rules, a practice run can be done at the computers. This may consist of exploring the software initially and becoming familiar with all the activities offered in Math Blaster, including how to type in tutor/ tutees' names and choose an appropriate math level. After a review of tutor/tutee roles, the teacher can pass out point sheets and have the students practice playing one of Math Blaster's games. Each pair should be monitored and rewarded if tutors remember to praise, encourage, and problem solve appropriately. Some pairs may need more time and direct instruction on using the software. If this is necessary, the teacher should explain to the tutor that he or she is modeling the tutor's role for the next CWPT session. Partner problem solving should also be modeled.

Step 3: On-going Classroom Management
After pairs understand their roles, the point sheets, and the software instructions, CWPT can begin. A set of signals (one or two fingers raised) needs to be planned so that one or both partners can request help, if needed. Students should be encouraged to discuss activities and problem solve aloud; this allows for active learning and participation. Besides points, younger children may need the added reinforcement of being allowed to color sections of a picture sheet each day CWPT is used. A reward ceremony on Fridays is an excellent way to encourage tutors to uphold their contracts.

SUMMARY

Students with learning problems need the kind of structure embedded in CWPT (Miller, Mercer, & Dillon, 1992). The arrangement allows for (a) demonstration and modeling by tutors (and teachers), (b) verbalization of processes, and (c) guided and independent practice. Integrating CBI and CWPT gives students a third partner: the computer. With careful planning, training, practice, and ongoing classroom management, skills in technology can be extended to other skills such as arithmetic computation, problem solving, and workplace cooperation. The combination of CBI and CWPT offers a structured learning environment that encourages active student participation. The problems and promises of integrating CBI in a diverse classroom can be shared by eager peer tutors, who become extensions of the teacher and partners in technology.

Persons interested in submitting material for Technology Tips should contact Diane Pedrotty Bryant, University of Texas at Austin, Special Education Dept., SZB 306, Austin, TX 78712. The Author Guidelines provide a description of content and format for this department.

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