

Effectiveness of PLATO in Improving Reading Skills

Background

A majority of the students at Sierra Nueva Continuation High School are low performing readers, indicated by the last Stanford Achievement Test, 9th edition, (SAT 9) results, i.e., in reading sophomores tested at the 16th national percentile ranking and juniors at the 15th percentile ranking. However, the teaching staff was well aware of this problem long before this test was administered to the students. Although the teachers at Sierra Nueva have tried various strategies to improve the reading level of the students, having to deal with a population that has a history of low achievement and absenteeism has hampered the teachers' success. The San Juan Unified School District purchased the site license to use Programmed Logic for Automatic Teaching Operations (PLATO) as a district-wide intervention to bring up the scores for those students who are identified as low performing readers. As part of Encina High School's Digital High School grant, awarded in 2000, Sierra Nueva purchased 8 Hewlett Packard (HP) computers that were connected to Encina's PLATO network. Six months later, Sierra Nueva was given 12 more HPs and a server dedicated to the PLATO program with the necessary network cabling. This August those students reading below 25% in the national percentile ranking of the SAT 9 (administered Spring 2001) were scheduled into one of the two PLATO reading lab classes.

Area of Focus:

This study investigates the influence of the PLATO reading program on the reading ability of the students who are enrolled in the PLATO lab.

Rationale

As state and national agencies pour millions of dollars into new computers and networks, Bartles (2000), questioned whether this was a wise expenditure of scarce resources and what evidence there was that supported the use of computers as a teaching tool.

A nagging sense that technology isn't doing what we wish it to, coupled with a lack of data showing outcomes or targeted planning, has provoked serious public discussion of whether the investment is worth the cost. It's a fair question. We should be prepared to answer it with data – before it is answered for us (p. 3).

As advocates for the use of computers in education continue to push for more funding, it is crucial that research demonstrates that computer-based instruction/learning is effective and worth the investment.

Review of the Literature

In 2000, the national media reported the Alliance for Childhood study, *Fools Gold: A Critical Look at Computers in Childhood*, which brought into question the use of computers in the classroom. In this study the authors posed many questions about the effectiveness and cost benefits of the use of computers in schools across America. They found that there was no clear evidence that the use of computers produced real gains in achievement (Cordes, 2000). Additionally, while there was some evidence that drill and practice activities on a computer did bring about some improved scores on national tests, it was found that one-on-one tutoring was less expensive and produced better results. This study also raised some questions regarding the overall benefits of computer use in school. It found that prolonged exposure to computer use produced some negative effects, such as a loss of community building and personal commitments, and that extensive computer use may harm a child's ability to generate his or her own ideas and images.

In the report, Cordes (2000) indicated that somewhere around 27 billion dollars was spent in the last 5 years on the purchase of computers for schools in America. In California, the California Education Technology Task Force (2000) urged the state to spend nearly 11 billion dollars for technology over the next several years. Given the huge sums of money being spent on computers for the classroom, the writers of the report questioned whether money is being shifted away from areas that may be more beneficial to the overall growth of a child, to a form of technology that is largely unproven. This report raised the question of whether educators should proceed with this kind of investment before research has generated more definitive evidence that supports the use of this technology in the classroom.

Three learning theories

With the advent of computer-based instruction (CBI) or computer-based learning (CBL) arose the need to view these instructional methods from a theoretical perspective. Three learning theories have been used to explain and justify CBI strategies and the methods that have been utilized. They are Behaviorism, Cognitivism, and Constructivism. The oldest of the three theories is Behaviorism, best known from B. F. Skinner's writings from the 1930's. This learning theory supported and explained programmed learning

which was developed for computer use in the 1950s and 1960s. According to Behaviorist theory (Semple, 2000), learning has taken place when there have been observable changes in behavior, based on a stimulus-response process. Learning has occurred when each step in the learning process has been short and in a sequenced order, accompanied by regular reinforcement, with immediate feedback. Drill and practice programs became the primary form of CBI based on Behaviorism. Software programs, using this model, were developed in which students would work through sequential tasks, starting at very simple tasks and continuing until they mastered more difficult tasks. Learning was demonstrated as they correctly performed each task in the drill and practice module. Drill and practice programs also provided record keeping facilities, so the teacher, as well as the learner, could see a report of what skills had been mastered and which ones needed more practice. These records or reports would act as a reinforcement or motivation for the learners, and as a means of evaluation for the teacher.

According to Semple (2000), the advocates of Cognitive Learning Theory, believed that learning is more than changes in observable behavior. Learning, according to Cognitive Theory, was believed to be a process in which the learner has made symbolic, mental constructions. Computer technologies are cognitive learning or mind tools that can increase cognitive abilities. These tools activate thinking which produces learning. An example of such a tool is the software program Inspiration. As the learners use this program, they are able to express their thinking and organize their knowledge in their own personal way.

Constructivist theorists postulated that children construct their own knowledge through defined experiences in accordance with their cognitive development. The role of the teacher as presented by Semple was to organize and support appropriate learning environments based on the cognitive state or status of the child. This was a very personal description of learning and the learning process. Vygotsky and others have added a social component to this theory, by stating that learning has a social context and that an individual constructs knowledge in transaction with the environment, and in this process both are changed. Collaboration among the learners was essential for the construction of knowledge, for this process brought new perspectives and additional understanding. The use of multimedia authoring tools can be an excellent way to facilitate constructivist learning. This technology allows students, in a collaborative environment, to create interactive lessons, projects and presentations by integrating images, text, animations, audio and video sources.

Computer-based instruction

The use of computers in an instructional capacity emerged in the early 1970s. During this time they were primarily used for drill and practice activities. However, as computer equipment and software became more sophisticated, more complex and elaborate learning activities took place. As schools began the increased purchase of computers for educational purposes, educators began questioning which types of computer-based activities were successful and which ones were not. Researchers began to investigate the use of computers in an instructional setting. However, many of the initial studies were impressionistic, relying on subjective observations with little empirical evidence (White, 1988). More specifically, Haile found that there was a shortage of research done on minority populations of all SES backgrounds and the effects of CBI in relation to students' ability (Haile, 1990).

The fact that CBI has been shown to be effective in one instructional context and then ineffective in a different context compounds the problem of evaluating the effectiveness of CBI. For example, while a particular use of CBI might be effective at grade 4, it is not at grade 5, 6, or 7 (Jacobson, 1991). Similarly, research found that there is a gender difference between how girls and boys respond to the use of computers in the classroom. Girls reported that they had a greater interest in applications like wordprocessing, while boys showed a greater interest in programming (MacGregor, 1985). Also, students from wealthier schools were more likely to learn to program a computer, and students from poorer schools were more likely to receive remediation in basic skills delivered by a computer. Students in minority schools used drill-and-practice software more than programming activities, while correspondingly low SES but predominantly white schools reported higher use of programming with their students. Students who were identified as high achievers were more likely to receive instruction in programming and problem-solving activities. Low achievers were scheduled into drill and practice computer assisted instruction for the purpose of remediation. Such factors as race, gender and SES may have accounted for the lack of definitive research on the effectiveness of CBI. Another study found that CBI programs may favor those learners who can quietly concentrate, stay with a single task, and memorize details (Haile, 1990). Haile estimated that as much as one-half of the student population might not be amenable to this type of instruction. With the multiplicity of factors as described above, it is easy to see why research on this issue

comes up with such contradictory results and why the study of these issues is so difficult. Each variable compounds the difficulty of isolating the actual effects that CBI has on students.

The Heritage Foundation recently released report on the question of whether computers increase the academic achievement of students stated that previous research has been inconclusive at best (Johnson, 2000). The Foundation used data from the National Assessment of Education Progress (NAEP) assessment to determine what, if any, improvement was made through the use of computers in the classroom. The study found that students who used computers in the classroom at least once a week did not perform any better on the NAEP reading test than those who used a computer less than once a week. Students who used computers predominantly for drill and practice, as opposed to using them in ways that develop high-order thinking skills, tended to do worse on the NAEP reading tests. The degree to which teachers were proficient at computer use did have an effect on student performance, but even when students received instruction by well-prepared teachers, there was no significant difference in the reading scores on the NAEP. The conclusion that the Heritage Foundation reached was that there was not sufficient evidence to support the claim that computers can improve the reading scores of students.

This is not to say that there is no support for the use of CBI in classrooms. One study examining the effect of printed material versus computer presented material found that the computer presented material was just as effective as the printed-presented material (Brown, 1984; MacGregor, 1985). MacGregor (1985) in her study also found that CBI is at least as effective as traditional modes of instruction. There have also been studies that have reported on the effect of CBI on student motivation and attitudes. In one study, below average students in the fourth to sixth grade who used CBI for a two-year period manifested greater academic self confidence, expressing the view that they had greater control over their learning. Computer-based instruction can also have an effect on improving student interest in school. In one study, the treatment group showed a positive significant change in the category of general attitudes toward school (Grant, 1998). They also expressed an increased satisfaction in learning in general. Students with disabilities have also been shown to benefit from CBI, demonstrating increased time on task and better motivation (Smith, 1997).

One of the earliest uses of computers in an educational setting has been in the area of drill-and-practice, one of the most frequently used forms of CBI. In one study it was found that drill and practice

and tutorial instruction almost always produced good results, raising student achievement scores in one typical case by 0.47 standard deviations (Haile, 1990). Haile also found that the consistent use of any well-structured computer program for math or reading remediation benefited students in need of extra help. In addition, science simulations for minority students were determined to be more effective than any application in other content areas. The use of computer-assisted instructional programs was generally more effective in raising students' scores on standardized achievement tests than alternative approaches (Becker, 1987). Becker's study done in Canada on third and fifth grade computer classes found that the students in these classes made greater gains on a standardized achievement test than did the control classes. Another study in Salt Lake using elementary students reported that the computer classes made nearly four times the mean gains of the norming population. While the evidence is not overwhelming, many studies do show that computer-based instruction can be more effective than traditional-based approaches. What is clearly needed is research that is more rigorous and empirically based than what is available today.

PLATO

PLATO was developed in the early 1970's at the Computer-based Education Research Lab (CERL) at the University of Illinois as a result of the growing interest in computer-base instruction (Modesitt, 1989). Later in 1976, due to a lack of funding, CERL sold the product line to Control Data Systems (CDS), which continued to develop it. Today, PLATO is owned by PLATO Learning, Inc., an educational firm located in Bloomington, Minnesota.

The primary theoretical basis of PLATO was Behaviorism. Learning takes place, according to this theory, when the learner has been presented with a set of short, sequenced ordered tasks and then proceeds to master each of the assigned tasks. Mastery of each task must be demonstrated in order to move to the next task. Feedback and reinforcement are given along the way to show the progress students make. This process is closely associated with what is called mastery learning. In mastery learning, for a subject to be learned it needs to have been divided into well-defined learning units, in a hierarchical fashion, presenting the simpler skills first, then building until more complex skills are learned. Students must have mastered each skill in sequential order before they can be allowed to continue to the next skill area (Magidson, 1974). This mastery-based learning produced a learner-centered environment. The learner or student has become the focus of attention, as the learner has proceeded at his/her own pace, in the areas where skill

development was most needed. This is a highly efficient approach because the learner has been able to work at a self-selected pace and master just those skills in which he or she was deficient. Teachers, moreover, have been able to focus their attention on those students who need it the most (Fahy, 1985a). One result was that students were able to complete courses in less time than they normally would. (Nofstetter, 1981). Additionally, students who experienced this mastery-based learning approach using PLATO developed positive attitudes about learning and expressed comments that indicated that using PLATO was enjoyable (Magidson, 1974). When students were placed in a learning environment in which they were in charge of their learning, many students were able to learn more and faster and have a greater sense of satisfaction, which they may have been missing in a traditional learning setting. Under these circumstances, students were able to “learn to learn” (Fahy, 1985a, p. 11). Students whose learning was minimal with traditional teacher-based instruction were more successful with computer-based instruction using PLATO (Fahy, 1985b).

There was also evidence that lower skilled students needed learning approaches that were linear, small step presentation techniques which demanded less prolonged attention (Shatia, 1975). PLATO offered just that type of learning process. Students worked through lesson modules one task at a time. As they completed the learning task, they were given feedback as to their success or lack thereof. If they were successful, they proceeded to the next task until they finished that module. This approach has been shown to be effective with adult learners, many of whom have had long periods of time away from classroom instruction. In one study, adult students who used PLATO for math and language instruction, showed greater gain in these two areas as measured by the Adult Basic Learning Examination than the students who had traditional classroom instruction (Fahy, 1984). In another study of adult learners, those students who used PLATO averaged gains of 1.12 grade levels in reading achievement after an average instructional time of 13 hours, which was statistically significant compared to those that did not use the PLATO program (Caldwell, 1979).

In a study at Indiana University, some journalism student were scheduled into a PLATO lab to improve their grammar skills while others were scheduled into a non-computer based section. Those students in the PLATO lab had an ending mean score of 62% as opposed to an ending mean score of 42%

for the non PLATO lab students (Oates, 1981). This study also found that PLATO was the favorite learning activity of the 6 available choices.

Conclusion

The use of computers in an instructional capacity has been increasing dramatically over the last few years. Hundreds of millions of dollars each year are spent in this country for the purchase of computers for classroom instruction. Educators, researchers, politicians, and the general public continue to question whether this is an effective use of scarce resources for public education. This review of the literature has examined research to determine if computers are an effective way to improve student learning.

In general, the research on this question has not provided a conclusive answer. While there have been studies that have found that CBI has improved student learning and skill development, others either found no net gain or even, in some cases, found that students performed less well. This examination of the literature has shown that part of the problem is the insufficiency of well-designed, rigorous research conducted over the last few years. However, more students are spending more time on computers than ever before. There are more opportunities to study the effects of CBI on students because a greater proportion of students use computers in their classrooms. The sample size is much larger because more students from all grade levels and ability levels are now using computers as part of their daily learning activities. As research is done during this decade, educators will be in a better position to have the answer to the question of whether money spent on CBI is an effective use of learning resources.

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