Effects of using the Anytime Anywhere Learning Model (laptop program) for the enhancement of problem solving and critical thinking skills.

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Research Question: *Will the Anytime Anywhere Learning Program improve problem solving and critical thinking skills of students in K-12.*

Background on the Model: In the fall of 1996, Microsoft Corporation and Toshiba American Information Systems launched the Anytime Anywhere Learning Program, also called the Laptop Program, at 29 “pioneer” school sites across the United States. Teachers and students were given laptop computers loaded with Microsoft products. The pilot program was designed to demonstrate that providing every student with access to a laptop and eventually access to the Internet would produce substantial educational benefits by learning anytime and anywhere. There are now over 800 schools involved in this program.

Introduction:

It has been said that in the 21st Century we should be able to walk into any classroom and find a telephone, half-dozen new computers, a 27+inch ceiling mounted monitor, a scan converter and a link to the state of the art media management system. Higher education has gone one step further and in some instances has encouraged each student and every faculty member to have a laptop computer, (Wake Forest University, Duke, & University of Minnesota-Crookston) to name a few, now K-12 has followed suit. This is the age of technology. But why is all this technology being thrust at education? Why are schools fighting to be special or progressive? Why do they all want to be connected to the Internet?

The Internet has changed the way we communicate with friends and family, the way we conduct business, and how we shop. It has impacted nearly every aspect of our culture. In education it has become a major force. Popular journals such as Newsweek, mention that every fourth visitor to Internet sites is either a student or an educator seeking information. More than half of U.S. classrooms are connected to the Internet. The Snow-Rockerfeller Amendment to the 1996 Telecommunications Act states that $4 billion is to be spent on installing the Internet in every classroom by the beginning of 2001.

Schools in the industrial age were structured to support a model of education in which teaching was telling, and learning was memorizing. We are now in a global economy, where the knowledge and skills of a nation's workers are the key to its competitive success. Students need to learn about critical thinking, research, and communication tools that they will need to meet the challenges of the future. New views of cognition support a constructivist philosophy that suggests that the advanced skills of comprehension, reasoning and experimentation are acquired not through passive reception of facts, but through interaction (Owston 1997). This takes advantage of the student's ability to learn through experience, where analyzing and synthesizing can take place. This major shift in teaching style with the advent of computers and the Web is allowing students a greater autonomy in their learning, which they seem to enjoy. We are moving from a more didactic to a project-based approach. Educators need to keep in mind that with this new technology they will need to teach their students skills that will enable them to compete in the 21st Century and beyond.

Research informs us that 80% of what we remember comes from experience, and 95% from what we teach others (Rockman et al). Does the information and communication technologies like the Web support experimental approaches to teaching and learning?

One of the most highly touted programs that has been implemented into the classrooms is the Anytime, Anywhere Learning sponsored predominantly by Microsoft and Toshiba http://www.micrsoft.com/education/k12/aal/ In 1996, Microsoft and Toshiba began a Laptop Pilot Program at 52 schools across the United States in which students have 24-hour access to laptop computers and the computers are fully integrated into classroom instruction. An independent research organization (Rockman et al, 1996) was contracted to explore and assess the laptop program implementations. During the 1996-7 school year more than 400 teachers participated in the evaluation process. For the 1997-8 studies they did a combination of surveys on observations, simulated problem solving tasks and students interviews. Researchers found that students with full-time access to laptop computers apply more problem-solving (cognitive) and critical thinking skills, and are more motivated and interested (socio-affective) in core academic subjects and produce higher quality work (productivity), especially writing. During the third year of the laptop program Rockman et al continued to examine impacts on teaching and learning within laptop classrooms, and researched the ways in which laptops might be supporting a more constructive pedagogy. They were also asked to focus on the possible impact of students' full-time laptop access on standardized test scores.

For the implementation of a laptop program to work, the plan is the secret to the success. Rockman et al (2000) recommend that planning the project is the most important task. With a solid plan, the implementation will move confidentially along the right path. The task of implementing technology is never easy, there are many pitfalls. Stated upfront though there can be preventive action in place. Whether one is dealing with 14 districts or a single school of 100 students the problems are almost the same, just the magnification is different.

The AAL program has wireless capability and for the Internet to promote improved learning there has to be opportunity for accessibility Owsten (1997). This raises the question of equal opportunity in education, as does the problem of equity (funding), which is also of major importance. Technology is expensive. Computers and their Internet connections are hot issues amongst educators and politicians alike. Even in predominately high-income schools, there are families who will find it hard to provide their child/children with a laptop computer, and in preparing the AAL model project this is an issue that needs to be resolved. Although many schools have high computer/student ratios, many have computer labs, which do not facilitate general interactive use. Hence, laptop computers are far more suitable.

On Wednesday April 5th 2000, educators joined business and government leaders in Washington to stress the importance of computer training for all Americans. President Clinton chaired the conference, stating that, “An education system that is not keeping pace with technological advances may be the Achilles heel of America’s new economy.” Microsoft Chairman Bill Gates and Federal

Reserve Board Chairman Alan Greenspan led a group of authorities that warned that failure to improve the education of all Americans could create a computer-illiterate underclass. Clinton welcomed the message that came one day after his "national call to action" to close "the digital divide."

As educational leaders we must rise to the challenge to provide technology support and training to insure that students and faculty are prepared for life in the 21st century. Clinton said that technology is not for "haves" and "have-nots." Teachers must support its use. Students expect it; they readily see its capabilities. As the Milken Exchange said, "We must all be accountable. The public is looking for a return on its investment and it rightly should."

Literature Review:

The Theories:

Establishments of higher learning had implemented Computer Based Instruction (CBI) long before K-12 had been able to establish it into their curriculum. Early evaluation studies of Computer Based Instruction (CBI) began to appear by the late 1960's and early 1970's, which in general supported the effectiveness of computer-based teaching as a supplement to conventional instruction. CBI was reported to reduce time required to learn and to be effective for teaching mathematics and a number of other disciplines (Kulick, Kulick & Cohen, 1983) Research has also suggested that instructional software can encourage self-monitoring in students as they work independently (Krendl & Lieberman, 1988). The software can provide instruction about metacognitive

strategies, model those strategies, and coach the learner through the process. By delivering feedback and posing appropriate questions, it can force students to think about their own thinking when they attempt to solve problems in a computer-delivered activity. These reasons are some of many that have encouraged educators to recommend laptop programs.

Following Computer Based Instruction, numerous instances of Multimedia appeared, this drew a plethora of research including a revitalization of the debate between Clark's *Media will never influence learning,* (1994) and Kosma's *Will Media Influence Learning? Reframing the Debate,* (1994) which debated the issue. Kosma (1994) states that we need to change our thinking from "Do media influence learning?" to "In what ways can we use the capabilities of media to influence learning for particular students, tasks, and situations?" Clark (1994) contends that media research is a "triumph of enthusiasm" over substantive examination of structural processes in learning and instruction. He claims that only the use of adequate instructional methods will influence learning. He states that any necessary teaching method can be delivered to students by many media or a variety of particular students, tasks, and situations?" Jonassen, Campbell & Davidson (1994), argue that the debate between Kosma and Clark, which focuses on the relative importance of media attributes vs. instructional methods, is the wrong issue to debate. They state that the debate focuses too exclusively on objectivist and instructionist conceptions of media and is therefore inappropriate in the context of contemporary learning theory. Questions about

the role of media should focus on the effects of the learners' cognitions with technology as opposed to the effects of technology.

The constructivist view of education supports the student-centered approach. (Kearsley & Shneiderman), state that “learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge.” Cognitive structure provides meaning and organization to experiences and allows the individuals to go further than the original information learned. (Kearsly & Shneiderman), state that with this method the student can learn at his or her own pace, the instructor is a facilitator. “Within the constructivist view point, curriculum should be organized in a spiral manner so that the student continually builds upon what they have already learned.”

Jonassen (1994) mentions different rationales for using technology as cognitive tools. “Students should use technology as tools…cognitive tools require students to think mindfully in order to use the application to represent what they know.” He states, “Cognitive tools and environments activate cognitive learning strategies and critical thinking.”

In Bruner’s constructivist theory he states “learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge.” He contends that the instructor should encourage students “to discover principles for themselves.” The AAL model encourages learners to do exactly this.

Active learning is a subset of constructivism and is playing an important part in the student-centered approach today. Fink’s model of active learning

suggests that all learning experiences have two kinds of dialogue, “dialogue with self” and/or “dialogue with others.” The two main kinds of experience are “observing and doing.” For teachers to implement this model they need to, expand the kinds of learning experiences they have been traditionally using. With a laptop program, students can be encouraged to search the web, use email, go live and chat or view, areas that will help them expand their knowledge base. The power of interaction is strong. “A teacher who can creatively set up a dialectic of learning activities in which students move back and forth between having rich new experiences and engaging in deep, meaningful dialogue, can maximize the likelihood that learners will experience significant and meaningful learning.” (Fink).

Technologies:

Nothing has captured the imagination and interests of educators in this century more than the World Wide Web. It is a unique way of linking text, images, sound, and video resources on computers connected to the Internet. The Web is causing educators to rethink the nature of teaching, learning and schooling from pre-school to graduate school. The World Wide Web (1990) was developed first to provide a way in which physicists could communicate more easily and rapidly with each other. Used first by the military and major universities and research centers, the center of the Web activity has shifted to the commercial sector. Now, virtually every business and higher education establishment from General Motors to the local pizza parlor advertises itself in

cyberspace. When students leave school with their high school diploma, it is becoming necessary for them to have some form of computer-based education.

In his paper *Web-Based Instruction (WBI): What is it and Why is it?* (1997), Badrul Khan mentions the dream he had in the 1970's while he was growing up in Bangladesh, on having access to well-designed learning resources that were only available to students in industrialized countries. It was unthinkable then that we would have the access to what we have now. As the Internet is emerging, the Web has become an increasingly powerful, global, interactive, and dynamic medium for sharing information. It is providing an opportunity for students to develop new learning experiences that were not possible previously Web-based instruction (WBI) is seen as an innovative approach for delivering instruction to a remote audience, using the web as a medium. Traditional lectures can become Web- based multimedia learning experiences for students. The Web can be used as a vast resource site for students all over the world to access. Khan (1997) states that WBI design requires careful consideration of the Web's potential in relation to instructional design principles. An understanding of capabilities of WBI components and features can facilitate the design of meaningful learning components and features can facilitate the design of meaningful learning environments and relevant learning opportunities.

Since the invention of writing there has been numerous technologies, each of which it is claimed has the potential to 'revolutionize learning' (Alexander, 1996). These technologies are released in a ‘flurry’ of excitement but often end in disappointment when evaluation studies fail to reveal the much-anticipated

improvement in learning. For more than 15 years now, students have been given opportunities to do all or part of their writing on computers. After many years of testing the impact of word processing on student production, the research verdict is unclear. There is no conclusive evidence that the current generation is writing more powerfully or more thoughtfully (McKenzie, 1998). In fact the trend in writing proficiency has fluctuated throughout the years. The National Assessment of Educational Progress (NAEP) reports little improvement in student writing during the past decade despite the billions invested in classroom computers and the significant increase in students reporting use of computers for writing. Statistics show that the average writing proficiency for fourth-grade students was about the same in 1994 as in 1984. Eighth-grade writing scale scores declined between 1984 and 1990. Eleventh-grade scores were slightly lower in 1994 than in 1984, (NAEP, 1994).). Strategic teaching is the key to learning. Placing laptops and tool software in student hands does not automatically produce better writers, but combined with appropriate instruction and tutoring the computer can be a wonderful aid. The ease of revision permits us to review and organize time and time again (McKenzie, 1998).

This new networked technology is part of the cause of the paradigm shift that is taking place not only in education, but also first and foremost in industry. In the networked society of the 21st century many people will need very different skills than that of their counterparts of the last fifty years. Research has indicated that high level thinking skills are of the utmost importance. In addition to the skills of analysis, used to identify relevant knowledge and the skills of evaluation

to judge the usefulness of this knowledge for the task at hand, the worker must also posses the skills of synthesis (Dyrud, Marilyn). Bloom's taxonomy (Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation), has been around for a long time and as Romiszowski (1996) points out that as we progress into the 21st century the importance of appropriate strategies and methodologies for the development of the following three categories of creative thinking analysis, synthesis and evaluation, will become increasingly important. It may be argued that this is where the core curriculum of any basic schooling system should focus its attention in the future. Learning can change with the addition of rich information and powerful tools. We should see tremendous growth of independence along with an increase in the range, the depth, the complexity and the originality of the thinking and production of our students (McKenzie, 1998).

AAL Schools:

At the Florida Independent Schools Technology Association (FISTA) meeting (Jacksonville 1998), there was a presentation by Sister Cooke who was the headmistress of Forest Ridge School of the Sacred Heart in Bellevue, Washington, www.forestridge.org Cooke explained that they had a vision in the curriculum with the outcome being to enhance learning. They moved from the classroom model of computer labs to the Anytime, Anywhere Learning model of a computer for each student and for each teacher. Technology has moved into the classrooms where access was guaranteed. The teachers were given access

and training and it was all curriculum driven. The laptops that the students owned gave them a sense of importance and collaboration. Although the teachers were in charge of delivery the students were in charge of his or her own learning. It was found that many more engaged learners were focused on learning. In this kind of learning environment teachers become guides or facilitators and students architects of their own learning. The teachers are perceived as coaches and problem solvers. They provide criteria for student assessment and function as a partner in learning. The students apart from assuming responsibility for their own learning, experiment with possibilities, reflect on their own work, and most importantly function as a team worker cooperating and collaborating. The laptop became their toolbox. Something that was started in class could be continued anytime anywhere. There are schools in Australia that have been doing this for six years now and have had great success. Integration of technology helps to expand ways of learning. It increases reflection, facilitates revision and fosters creativity (Relan & Gillani, 1996). It also facilitates problem solving and strengthens communication skills. The success of technology integration in education is partly due to strategy that Sister Cooke describes as "Share the Vision." For it to succeed in a school it has to be a collaborative effort that includes the teachers and students, the administrators and board, the parents, the alumnae and friends and the wider community. The schools mission statement on technology states, “We believe that consistent and constant access by the individual learner to the learning tool of her era strengthens her evolution as a critical thinker, thereby ensuring her success in

the future. Forest Ridge is actively engaged in creating curriculum that enhances our student's development as critical thinkers."

Eleanor Clute, Post-Gazette Education Writer wrote, (September 2000) about Greater Latrobe Junior High School, "One of the biggest changes was in the district's own writing tests. In 1997 and 1998, an average of 70 percent of ninth-graders could meet the district's exit standard for writing. But in 1999, 81 percent of the ninth-graders met it". The school began to implement the laptop program in 1998 to eighth and ninth grade pupils.

Tom Greaves in his paper "One-to-One Computing Tools for Life (Technology Information) May 2000, stated that the elements of one-to-one computing are built on five basic elements: a portable, wireless computer, computers that function as part of a large system that includes a LAN infrastructure, training for students, teachers, and parents, a system that is comprehensive and integrated with an Internet-based curriculum with an emphasis on teacher-driven lessons and student-driven learning, and a system that has continuous broadband connectivity. He cites results coming from schools that are seeing dramatic results. "For example, Rio Bravo Middle School in El Paso, Texas, one of the poorest cities in the U.S., reports that student scores on the Texas State Achievement Test improved from 83% to 95% in math, and from 87% to 92% in writing over the previous year."

Research:

In Texas the education agency has announced that it will select 14 school districts and 21 technology and curriculum companies to conduct innovative pilot programs that use existing and cutting edge technology in an effort to boost student learning. In a report from the agency in 1999 called “Report on the computer network study project,” they found that according to research data, technology had a significant impact on teaching, administration and on student performance, attitudes and behavior.

Rockman et al continued in their third study to investigate impacts on teaching and learning within laptop classrooms, and to see if there were possible effects on standardized test scores. Although AAL was not designed specifically to improve test scores, the research was looking at implications that it may affect them. The initial sample of 13 schools at 12 different sites brought reliable data from eight sites. They had 450 students and 50 teachers participating in the research. In addition to collecting test scores, they administered surveys and questionnaires, and asked students and teachers to keep logs. Students were asked to fill out a student questionnaire, a learning strategies survey, and a computer use log; students at matched sites were asked to complete a writing activity as well. Teachers were asked to complete a survey and a class log. Principals and administrators were interviewed, and standardized test scores form a variety of state-and nationally-normed assessments were analyzed.

With the exception of standardized test scores they found a consistent benefit for the teachers and students in laptop environments: greater technology

skills, more constructivist pedagogy, greater use of computers, improved writing. However they did not as yet find substantial gains on standardized assessment measures. They also stated that “the curriculum content covered by the participating teachers and their students, and the competencies and abilities that students brought to the testing setting are likely to contribute more to the outcomes than ubiquitous access to computers.”

Conclusion:

Research is beginning to prove that the AAL program can be effective in the way students learn. It was noted from the Rockman et al research (2000) that access to technology has increased for all, although opportunities for individual access are still greater for Laptop students. Laptop students consistently showed deeper and more flexible uses of technology than their Non-Laptop matched groups. Laptop teachers showed significant movement toward constructivist teaching practices, and indicated that computers played a major role in that change. However these attributes did not appear on the standardized assessment measures used in the Rockman et al (2000) study. This does not mean that the Laptop program did not impact academic achievement, but possibly the measures used in the study were not able to identify the outcomes.

We have in our hands now, a mouse click away, an amazing potential, and a treasure trove of information to be gleaned. Educators have to develop effective planning programs so that student potential and performance can be stretched in productive directions. Educators have to teach their students to

become skilled thinkers, researchers and inventors. A curriculum needs to be designed that is suitable for the age of Information, and one that can be used with the laptop computer program. With the Internet and a bank of technological equipment that is needed to support it, we may see the effect of "improved learning" in the areas of problem solving and critical thinking.

Purpose of the Study:

The purpose of the study is to investigate whether the Anytime Anywhere Learning Model (laptop program), improves student's problem solving and critical thinking skills.

Statement of the Hypothesis:

It is hypothesized that the Anytime Anywhere Learning Model will have little or no effect on the improvement of problem solving and critical thinking skills of students.

References

Alexander,S (1995) Teaching and learning on the World Wide Web. [On-line]. Available http://www.scu.edu.au/sponsered/ausweb/ausweb95/papers/education2/alexander

Anytime, Anywhere Learning: A guide to getting started. (1999) [On-line]. Available http://www.microsoft.com/education/k12/aal

Bruner,J. (1966) Constructivist Theory. [On-line]. Available www.gwu.edu/~tip/bruner.html

Clark, R. (1990). Instructional media and technology research. International Journal of Educational Research, v14 n6. 485-579

Clark, R. (1994) Media will never influence learning. . Educational Technology, Research and Development. v42 n2. 21-29

Clute, E. (2000) Laptops for all at Junior High. [On-line]. Available www.post-gazette.com/regionstate/2000924laptops3.asp

Dyrud, Marilyn. (1998) Critical thinking. (thinking skills in education)(Focus on Teaching) Business Communication Quarterly; Sep 1998, v61, n3, p62(2)

Fink, L,Dee. (1999) : Active Learning [On-line].Available. www.hcc.hawaii.edu

Greaves, T. (May 2000) One-to-one computing tools for life (technology information) T.H.E (Technological Horizons in Education); v27, 10, 54

Jonasson, D.H. (1993) Technology as cognitive tools: Learners as designers. [On-line]. Available. http://itech/coe.uga.edu/itforum/paper1/paper1/html

Jonassen,D., Campbell,J., & Davidson, M. (1994). Learning with media: Restructuring the debate. Educational Technology Research and Development v42 n2. 31-39

Kearsley, G., & Shneiderman,B. (1999). Engagement Theory: A framework for technology based teaching and the theory into practice database. [On-Line]. Available: http://www.gwu/~tip/index.html

Khan, B. (1997). Web-based Instruction (WBI): What is it and why is it? Web-based Instruction Ed. B. Khan. Ed. Tech Pub.

Krendl, K., & Lieberman, D. (1988). Computers and learning: A review of recent research. Journal of Educational Computing Research; v4 n4. 367-89

Kosma, R. (1994) Will media influence learning? Reframing the debate. Educational Technology, Research and Development; v42 n2. 7-19

McKenzie, J. (1998) Learning Digitally. From now on the educational technology journal. [On-line]. Available. http://fromnowon.org/nov98/digital.html

Milkin Exchange (1999) [On-line] Available. www.mff.org/edtech

Orr, M. & Fankhauser, R. (1996) Approaches to research in a digital environment-who are the new researchers? Learning Technologies,8.

Owston, R. (1997). The world wide web. A technology to enhance teaching and learning? Educational Researcher,v26 n2 27-33

Relan & Gillani. (1996). WBI & the traditional classroom: Similarities & differences. Web-based instruction and the traditional classroom: similarities and differences. Web-based Instruction. Ed.Khan, B. Education Technology Publications

Rockman et al. (1997). The laptop research study. [On-line]. Available. http://www.microsoft.com/education/k12/aal

Rockman et al. (1999). The laptop research study. [On-line]. Available. http://www.microsoft.com/education/k12/aal

Romiszowski, A. (1996). Web-based distance learning and teaching: revolutionary invention or reaction to necessity? Web-based instruction. Ed. Khan, B. Educational Technology Publications

The Sacred Heart (1998) [On-line]. Available. http://www.forestridge.org