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The need for handheld computers in the classroom

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THE NEED FOR HANDHELD COMPUTERS IN THE CLASSROOM

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Abstract

The handheld computer has become a viable tool for education. It costs less, weighs less, and takes less space in the classroom than a desktop computer. This review of literature shows the merits of using handheld computers in the classroom.

In order to appreciate the handheld computers, one needs to research the history of computers and how the handheld computer is being used in the corporate world, as well as, by educators. By researching handheld computers past use and current trends, it should be possible to evaluate their impact in the classroom.

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Introduction

The idea of having one computer for each student is not a new concept. Handheld computers are becoming a popular classroom computer option for educators. In addition, handheld computers also allow students to study at home with their parents. Soon after handheld computers arrived educators began to see the merits of using the small devices in their classrooms. School districts are moving in this direction, as funding becomes available (Paftak, 2000).

This review will define the handheld computer as a personal computer small enough to hold in one hand and light enough to carry in a pocket, purse, or briefcase (Brown, 2001). They had been referred to as PDAs or Personal Digital Assistants, although handheld computers is replacing that term. Various computer companies are developing handheld computers. It is not the intent of this review to compare the handheld computer models.

Educators who decide to use handheld computers do so for their potential to impact education, cost value, and ability to compensate for space limitations. The handheld computers have the potential to extend the time spent learning each day, to help students become organized, and to make learning more equitable. In addition, students benefit from immediate feedback and individualized instruction. Handheld computers can also be used as calculators with calculator software available online. Handheld computers can store whole textbooks and assignment notebooks, decreasing the weight of student backpacks. Educators who have incorporated

handheld computers into the curriculum have found improved school-to-home relations (Curtis, 2002).

The intent of this literature review is to analyze the potential of handheld computers in the classroom. It does not focus on the positive or negative aspects of computers in education. Instead, this review focuses on the positive aspects of handheld computer usage and whether or not handheld computers can make a difference in education. Concerns related to the use of handheld computers will also be addressed.

Schools will need to adopt new technologies to survive in the 21st century. Handheld computers in schools will allow the students to use technologies that will become the norm in the business world (Rutowski, 1998). Handheld computers have become more popular and may eventually become a necessary part of each classroom. This literature review will analyze the latest information to determine whether the use of handheld computers should be encouraged or discouraged.

The old instructional methods of relying on books and papers for completing assignments did not allow for student interactivity. Handheld computers have this potential. Combine this interactivity with the affordability of handheld computers, and the potential to impact instructional change in the classroom is real.

The description of handheld computers in this review will serve as a guide to how their use can meet the needs of many students. For instance, some students may need special assistance from the use of handheld computers because they are gifted or handicapped. Some students may need remedial reading assistance (Poftak, 2000).

The ability to individualize instruction with handheld computers would allow educators to plan individualized educational plans.

This review asks questions. Can the use of handheld computers extend the school day? Would handheld computers help students organize better? Are handheld computers a more equitable use of technology? Can students' instruction be individualized and offer immediate feedback through using handhelds? Could handheld computers serve as calculators? Could the handheld computers replace items in student backpacks? Would the handheld computer improve school-to-home relations? Will students be more motivated to learn while using handheld computers? Do staff development resources need to be a priority? This review also provides a picture of where handheld computers are heading in the future.

Methodology

In researching the use of handheld computers, this author used many information sources. The University of Northern Iowa Rod Library and its web site were valuable sources of research. The UNISTAR and Philosopher's Index databases were used extensively. The UNISTAR database was easy to navigate and information available was current.

The researcher also browsed the Internet. The Internet search indicated hundreds of available sites dealing with the phrases "handheld computers" and "palm pilots". The work of researcher, Elliot Soloway, was also searched. Web sites were screened for reliability and with an emphasis on recent publications. Web sites which listed references or were linked to professional sources were given high priority. Current periodicals and books were selected based on their relevance to handheld

computers. Authors who had multiple publications in the field of handheld computers were sought. All references were deemed credible and worthy of being included in this research.

Discussion

This section of the literature review will analyze four key issues important to handheld computer success. To understand the potential of handheld computers it is first important to understand the progress computers have made in the past in education. The history of the handheld computer was searched to give perspective on its past. Corporate use of handheld computers was also searched to show the impact currently made by handheld computers in the work force. Finally, the use of handheld computers in education was searched to show its current impact on education.

One of the newest trends is the use of handheld computers as an educational tool. It is possible to take them anywhere students travel and use data. This technology is eliminating the isolation of students. The handheld computers allow for sharing of data and encourage collaborative activities. Students have the ability to save and share data. Some handheld computers allow data to be downloaded from desktop computers (Trotter, 2001). This connectivity allows students to work at school and at home on educational activities. Projects can be created at school and completed at home. Students also have the opportunity to work with partners after school without the need of the school computer labs. To appreciate the potential of the handheld computer, it is important to understand how computers have evolved in history.

The History of Computers

The history of computers is an interesting study. The transistor was invented in 1947. The transistor made it possible to save large volumes of information in a relatively small location. In 1956 the first transistorized computers were completed at Massachusetts Institute of Technology. (Martorella, 1996). Honeywell released the H316 Kitchen Computer, the first home computer, priced at $10,600 in the Neiman Marcus catalog. At this point it was too expensive for most consumers.

In the 1960s, Seymour Papert advocated the inclusion of computers in schools. His ideas were not widely accepted. At this time computers were only available to the elite (Papert, 1980).

The 1970s changed the face of computing. Desktop computers gave individuals real computing power in small packages. These computers were used for activities requiring extensive calculations and allowed researchers to store large amounts of information (Pownell & Baily, 2003).

Desktop computers became smaller and more affordable in the 1980s. The Graphic User Interface (GUI) was created and easily learned. The Graphical User Interface (GUI) introduced many big changes to the way people interacted with a computer. A user interface based on graphics (icons and pictures and menus) instead of text; uses a mouse as well as a keyboard as an input device (Lineback, 2003).

While the GUI interface is perceived as being relatively new, it has had a long history in the world of desktop computers. On April 1973, the first operational Alto computer was completed at Xerox PARC. The Alto is the first system to pull together all of the elements of the modern Graphical User Interface. Its features included a 3-button mouse

and a bit-mapped display. On January 1983, Apple introduced the Lisa. It had a GUI interface which included pull down menus and menu bars. Visi Corp released Visi On, the first integrated graphical software environment for IBM PCs. It was becoming easier for individuals to purchase and use computers. As the computer evolved, it went through many changes. It was first accepted by higher education and business use. As its size and cost reduced, the desktop computer later became a tool that could be used in the K-12 education system. Computers are predominantly used for word processing, spreadsheets and presentations (Cuban, 1986).

In the 1990s, computers allowed more communication and collaboration between students. This was evident in students' desktop publishing, telecommunication, and project-based learning. After 2000, more computers became mobile. Students were able to take the handheld computers anywhere anytime. Handheld computers allowed wireless technology to expand (Lowe, 2002).

The History of Handheld Computers

In the mid-1980s the Apple Newton was introduced. It had handwriting recognition software, which did not function correctly and the screen was difficult to read. It was, however, lightweight and a handheld personal technology. Many of the handheld computers currently being used have been improved as a result of the feedback learned from the Newton computers. In 1991 Hewlett-Packard introduced the HP 95LX handheld computer. It required an understanding of MS-DOS 3.2 to use the computer. Palm, Inc., which was founded in 1992, introduced the Pilot 1000 and Pilot 5000 products in 1996. These products led the resurgence of handheld computing (McLesters, 2002).

In 2000, Microsoft released Windows CE 3.0 and launched the pocket PC. Many companies have introduced handheld computers since then. Each of these companies is competing in the handheld computer market. Recently, Sony introduced the Sony Clie PEG-NX70V handheld computer. It has 16-MB RAM, 320 x 480 color display and cost $600. The amount of available RAM and the ability to display more colors has improved through the history of handheld computers (Schartz, 2000).

Handheld computers are a visual representation of the innovations in our society. Most of the handheld computers were created with business use in mind. It was too expensive to be purchased by schools and lacked software to allow it to be effectively used.

The Corporate Use of Handheld Computers

Handheld computers are used in the business world. They have many uses, such as organizers and note taking. The corporate use of handheld computers is increasing. Doctors use them for patient names and to update patient files. Doctors can write prescriptions and keep updated on the latest medical news using the handheld computer. Sales people can keep track of inventory and quickly note sales contacts. Some Senators use them to keep track of important contacts (Schartz, 2000). College students can access wireless networks, view course syllabuses, and communicate with professors. The American Red Cross is using handheld computers to automate blood donations (Pownell & Bailey, 2003).

In the business world, time is money. Handheld computers allow people to have documents quickly assessable, and they are able to share information between

various technologies. Many of the qualities, which have made handheld computers attractive to the business world, are equally attractive to educators. Having computers that are lightweight, portable, act as organizers and have the ability to quickly store and transfer date are qualities that are attractive to both fields (Wood, 2002).

The Educational Use of Handheld Computers

Recent advances in handheld computers and software have brought them into the limelight in education. "Affordable and flexible handheld computers have the potential to facilitate, stimulate and consolidate learning into a personal repository that students can use to revisit and reflect upon" (Darling-Hammond 1997, p 35). It is this ability to personalize learning that has educators excited about using handheld computers.

Cuban (1986) advocated a moratorium on the purchase of computers in the classroom. Research shows that not many educators heeded Cuban's suggestion. In 1998 there were 3.9 million handheld computers sold with increases projected every year (Frauenfelder, 1999). By 2002 the number of handheld computers sold surpassed the number of desktop computers sold. The handheld computers are a tool which warrants further research.

Soloway (1993) believes that money should be spent on handheld computers instead of purchasing desktop computers. Soloway has developed a program at the University of Michigan, which is at the forefront in developing software and piloting the use of handheld computers in education. Hi-CE (Center for Highly Interactive Computing in Education) is working hard to find new and better ways to effectively

use handheld computers in education. This program is in the process of developing software for handheld computers.

In some schools, keyboarding is a common use of computers. This may be the students' only experience with computers or the basis of their experience with computers. This is a contrived or limited experience. Instead of rotating students on desktop computers as they take turns keyboarding, the lower cost of handheld computers would enable the schools to purchase more units for students. This would allow for all students in a classroom to do keyboarding at one time. Keyboards can be purchased with handheld computers and allow instructors to teach in a whole group setting. This would allow keyboarding to be taught at one time interval rather than as a rotating schedule. When there are more students then computers, teachers must rotate students and technology dictates how instruction is designed.

When technology drives instruction, some teachers see technology as another element that is taking away classroom instruction time. When computers are purchased and given to teachers with little training and limited software, the perception of the computer as a valuable tool is diminished. The handheld computer needs to act as an accepted tool. Educators need the time to integrate handheld computers into their curriculum. Staff development prior to implementing handheld computers would be important to the success of handheld computers (Tenbusch, 1998). As the handheld computers gain support, continued staff development opportunities should exist. A staff development plan will be made at the building and district levels. During this training knowledge will be shared and staff will be encouraged to take risks. Training will be available for new instructors, as well as,

for current instructors who want to try higher-level tasks. Staff development meetings will continue throughout the year and include surveys to assess each instructor's needs to succeed with handheld computers. Jamie McKenzie (1998) gives three reasons why technology is not used to its full potential in schools. They are "lack of clear purpose, too little support for adult learning, and poor design of technology staff development." Clearly, this view of technology integration emphasizes how important a sound and progressive staff development program is.

Fullan (1991) proposed that people do not know how to cope with change and so tend to resist it. Leaders need to be aware of the change process and how to help people understand and embrace it. Staff members sometimes need an example of how handheld computers can be used to see the merits of using the handheld computer in their classrooms. To help educators embrace handheld computers the book Palm Handheld Computers -- A Complete Resource for Classroom Teachers (Curtis, Williams, Norris, O'Leary, & Soloway, 2002) will be given to each staff member as a resource. This book would assist staff members as they learn to use the handheld computers. The book also shares ways to integrate the handheld computers into existing curriculum.

The location of the desktop computers in the classroom it is an important issue. The desktop computers should be located off to one side of the room, not to distract the other students engaging other learning activities. Some students are easily distracted by desktop computer monitors in the classroom. Handheld computers provide learners with less visual distractions. Students would be able to work independently, but could also collaborate with their peers on various projects

(Allen, Bowen, Clabaugh, et al, 1996). Computer-based work could be assigned outside of the school day, and brought back and shared the next day. This instantaneous generation of information leads to more accurate conclusions (Johnson & Broida, 2000). This would extend the daily instruction time. Combined with the Internet the handheld computer has the opportunity to require instruction beyond the current regular schedule. There would be the long range potential to individualize the instruction of each student, and maximize the time available to instruct at school and at home.

Handheld computers allow students to organize their homework assignments and optimize their time. Students can record notes and review these at a later time. Dates and places can be recorded to assist the students as they plan their schedules. The handheld computer becomes a tool, which is easily carried and is on hand when students need to check their daily status (Shields, 2002).

When schools provide learners with less visual distractions, handheld computers can be set for equitable use of technology. All students would have the use of handheld computers regardless of economic status (Bell, 1997). These handheld computers could level the playing field between the various social-economic groups. Larry Irving (1999) states that "there is a digital divide between those with access to new technologies and those without" (Page 74). Students who are in affluent areas tend to have more technology. This gives affluent students an advantage.

Handhelds enable the teacher and peers to make a rapid assessment of each student's comprehension of the concepts. It allows the teacher to build on the current

state of student understanding in order to provide on-going challenges that enhance each student's conceptual model. And it frees the teacher to analyze student weaknesses ,strengths, misconceptions, and process skills -- all during the lesson. Educators can then indivdualize lessons and develop curriculum which fosters independent learning (Tinker, Krajcik 2001).

Currently, some students are required to purchase a calculator. Handheld computers can be used as scientific calculators one minute, taking digital pictures the next, taking notes in class, or as scientific sensing devices (Carter, 2001). The need for separate graphing calculators for math students could be eliminated, as graphing calculator software is available for handheld computers. Graphing calculators cost approximately $240 and may be required for some math classes. The graphing calculator software is approximately $30. The average cost of a handheld computer is $120 dollars.

Schools may require students to purchase a handheld computer or provide them like textbooks in the near future. The handheld computer does have the potential to store whole textbooks of data. This would allow students to travel with less weight in their backpacks. The handheld computer has writing tools and allows students to take notes. Using a handheld computer could replace current assignment notebooks and notepads (Staudt, 1999). Each item replaced by the handheld computer lessens the overall weight of backpacks.

Handheld computers are small and can be carried easily. This gives students the ability to take their computing with them from class to class and from school to home. Handheld computers are "personal tools of inquiry" that can be used anywhere (Crawford & Staudt, 1999). Improved home-to-school communication is

the result. Parents are able to easily read notes and observe learning activities as their children progress.

Concerns

Security is a great concern with handheld computers. Because of their size they are easy to lose or steal. To remedy this situation, some schools require students to pay a deposit on the handheld computer (Fasimpaur, 2003). This gives a student some ownership for the computer and instills responsibility for its care. The deposit is refunded at the conclusion of the school year when the computer is returned.

Software for handheld computers is limited but growing. When handheld computers were first introduced, they arrived in the market with limited software options. Currently more titles are being developed. With the introduction of Pocket PC software the handheld computers are now able to function using the same software available on many desktop computers (Soloway, 1993).

Durability is another concern. Handheld computers need to be able to function in the hands of students. The handheld computers must be built to withstand use by students. The research has indicated that this has not been a significant issue, and handheld computers have performed well in this area (Trotter, 2001). In Trotter's study some handheld computers were dropped as well as carried in backpacks. These handheld computers withstood the abuse well. Students were trained prior to receiving the computers and were responsible with the use of handheld computers. Handheld computers come with screen protection devices. When students are properly trained in the care of handheld computers, the computers have the durability to last in the school setting (Brown, 2001).

Conclusions and Recommendations

Students who have handheld computers have the tools and the opportunities to work and complete projects at school and at home. Educators have found that students, who have technology available use this technology in creative projects that often reach completion after regular school hours (Shields, 2002).

Based upon the research in this review, a fourth grade classroom at Bridgeview Elementary School intends to implement handheld computers. As students leave the fourth grade, they have the opportunity to continue using handheld computers in fifth and sixth grade. Baily, Lumley, and Dunbar (1995) assert that one of the major barriers to technology integration in schools is a lack of planning. A solid technology plan is critical for the implementation of technology in schools. A long-range plan would be developed so handheld computers could be adopted in fourth through sixth grades.

A group of fourth graders will be trained to use handheld computers as a pilot project. The fourth graders will become a resource for trouble-shooting issues with their peers, and help support the fifth and sixth grade teachers as handheld computers are adopted in these grades.

The key to success with handheld computers is getting them into the hands of students. Grant writing should be encouraged. These funds will allow for paid staff development and possible visits to other schools where handheld computers are being used. Funding will also be used for the maintenance and replacement of handheld computers. As the computers are used, equipment malfunctions and accidents may occur. Instruction should not be impaired due to limited technology.

Having additional handheld computers to loan to students while repairs are taking place is also recommended (Brown, 2001).

Proper use of handheld computers is just as important as desktop computers. Pleasant Valley Community School District in Iowa is an example of a district, which has an Acceptable Use Policy that must be followed. The handheld computers work on a wireless network. A Network Administrator monitors the students' use of the Internet. Games are not allowed on handheld computers. Failure to comply with rules result in loss or limited use of handheld computers.

In conclusion, the research has indicated that handheld computers are making positive inroads in our society. Computers have become standard tools in many classrooms. Handheld computers have the power to replace desktop computers at less cost and space. Corporate use of the handheld computer continues to increase. Educators are embracing handheld computers and more software is being developed. Handheld computers have allowed students to extend the school day and gain important instructional time. Students are better able to organize themselves when using handheld computers. Handheld computers allow more equitable distribution of technology between students. When using handheld computers, educators are able to individualize learning and provide learning experiences that can give immediate feedback to students. Handheld computers have the potential to replace calculators as a stand-alone tool in schools. Handheld computers have the potential to store whole textbooks of data. As publishers make this information available, handheld computers could store information and replace heavy textbooks. Finally, the

handheld computer would allow schools to communicate with parents using a portable form of technology.

It is said that teaching patterns recycle again and again. Curtains replaced walls and then walls were designed to replace curtains. Currently tables are the trend in replacing individual student desks. This is an attempt to design the classrooms for better instruction, which will encourage cooperative learning. Handheld computers may replace desktop computers in the near future.

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