

Competing Visions of Handheld Computer Use in the Classroom

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The idea of using computers in K-12 classrooms to enhance or even transform learning is a relatively new one. Until recently, however, access to computers posed a significant challenge for educational computing evangelists. Desktop computers have been simply too expensive. Most schools have at least one computer lab, and teachers may have one or even a small “garden” of classroom computers, but these limited resources sharply restrict the daily and weekly computer access time individual students can realize. Hence, the digital divide continues, where students with a computer at home tend to have more digital literacy than their peers lacking a home computer. Digital literacy has largely developed in spite of rather than because of schools, thanks to families who provide greater access to technology in their homes than children can find in their schools.

Handheld computers hold promise to change these patterns, however. For the cost of a pair of tennis shoes, each student in a classroom, school campus, or entire district can have their own computer: a powerful tool small enough to literally fit in the palm of their hand.^[1] Despite this exciting potential, relatively few school districts have embraced a coherent vision of student handheld computer use. Different visions about the ways handheld computers should be used in K-12 classrooms abound in educational technology circles, and it is vital for parents, educators, and students to understand the defining characteristics, assumptions, and goals of these perspectives. While some of these visions of classroom handheld computer use may be complementary, some are clearly competitive. The “ideal environments of teaching and learning” promoted by these visions, and their associated software products and staff development training programs, can be starkly different.

QUALITY LEARNING ENVIRONMENT?

The different types of administrative and instructional uses for handheld computers discussed in this article beg vital questions about teaching and learning.

1. What does a quality learning environment look like?
2. What does it sound like?
3. How should technology be used to shape this environment?

4. Should technology define the environment?
5. Is technology a fundamental requirement for teaching and learning, or an optional add-on?

In the early years of the twenty-first century, we are living in an era where the vision of legislated “educational quality” is very different from the intuitive sense of educational quality that “the common man/woman” has. A straightforward way to demonstrate this is to ask a group of adults or young people to think about one their best instructional memories from elementary school. Then have them share their memory with someone beside them. Last, have volunteers share their memory with the group. No one will describe a fantastic standardized test they took in fourth grade, or an amazing worksheet they remember from second grade. In fact, none of the memories group members are likely to recount (possibly decades after the experience for some) will involve standardized assessment or a didactic, teacher-directed, lecture experience. Many of the memories will involve some type of classroom lesson that was essentially experiential. It may have involved the creation of a project, an interview with someone from the community, or a showcase when students shared the knowledge they had gained with others. The “quality learning environment” which allowed students to have long-term memories of lessons learned may not have used any technology at all.

I do not share this observation to suggest that technology is not needed in our classrooms to prepare students for their future: My position is actually the contrary. I share it to point out that discussions about educational quality in general, or specific programs like those involving handheld computers, should begin by focusing on first principles. As Ian Jukes has noted, many schools in our country have attempted for force feed “a curriculum that is a mile wide and an inch deep” down the throats of children of all ages, and one result has been countless hours of wasted instructional time long forgotten by students as well as instructors.[\[2\]](#) As Dr. Allen Glenn notes, “It is philosophy, not technology, that will make a difference in your classroom.” A defined vision for the learning environment should logically precede the adoption of a new technology solution, including handheld computers used by teachers and/or students. With these ideas in mind, let us examine some of the competing visions of handheld computing uses which abound in the educational marketplace today.

VISION 1. COMPUTER ENHANCED ASSESSMENT

One of the most prevalent and popular uses for handheld computers in the classroom focuses on ways these devices can improve assessment of student learning. State and national level legislative emphasis on standardized testing fuels the interest of administrators and school board members in solutions promising to improve student test scores as well as functional literacy.

Characteristics: A photograph from the Wireless Generation website (www.wirelessgeneration.com/web) communicates this vision effectively: The teacher is holding a handheld computer as she makes assessment notes about the performance of children in her room, while the children read books or respond in writing to prompts while she supervises. Rather than having to wait for tabulated results after assessments are complete, results are immediately available to the teacher, administrator, and parents.

Assumptions: This vision assumes that by better assessing the performance of every child in a classroom, the educational experience for each will improve. Most importantly, students not mastering specific grade level expectations will be identified so they can receive remediation. This vision assumes that the capability of teachers to individually assess students can be uniquely enhanced by the use of handheld computing devices and customized software tailored to the curriculum and standards already used by the classroom teacher.

Example: The software solutions offered by Wireless Generation (www.wirelessgeneration.com/web/) are one example. According to their website, "Our mobile tools support ongoing assessment of student performance and help teachers tailor instruction to each student's needs." Their "mClass" solutions (including mClass TPRI customized for the TPRI observational reading inventory utilized—in paper/pencil as well as electronic forms-- by more than 90% of K-2 classrooms in Texas) allow teachers to conduct observations of student performance electronically.

Ideal Learning Environment: Students engaged in traditional classroom literacy activities, supervised and directed by a classroom teacher armed with a handheld computer. Upon syncing her/his handheld computer, individual student performance data becomes accessible by the campus administrator, the teacher for later review, and possibly the parent during scheduled conferences.

VISION 2: MORE CENTRALIZED CONTROL OVER A TEACHER-DIRECTED LEARNING ENVIRONMENT

State and national standards for student learning emphasize the importance of a “student-centered” approach to instruction, yet the majority of classroom instruction in K-12 contexts continues to be teacher-directed. Technology tools offer the promise of further engaging students during teacher-directed lessons, since each student can have his/her own handheld device to manipulate and provide input immediately visible to the teacher. Teachers can receive immediate feedback on student performance.

Characteristics: Every learner in the classroom has a handheld or laptop computing device. Questions pre-selected or previously created by the teacher are wirelessly sent to student devices for a response, or students are asked to respond to a question displayed on a television or by a projector. Every student is engaged in the lesson, and the teacher receives immediate feedback from student responses.

Assumptions: During teacher-directed lessons (lecture), the level of student engagement is typically low. By providing each student with an electronic device, teachers can physically increase student engagement levels by requiring motor skill activity. Intellectual engagement typically accompanies physical engagement. Teachers typically share content during a majority of class time and assess for a smaller amount of time. By utilizing electronic wireless assessment devices, teachers can assess students more frequently and receive specific feedback about individual student mastery levels.

Example: Discourse software by Educational Testing Solutions (ETS – www.ets.org) is an example. Their slogan for teachers, “You will always know what they know,” implies the aforementioned assumptions. According to the ETS website, “In a lesson with Discourse, each student uses a computer to respond to every question and activity. You monitor each student's response, keystroke by keystroke, on your computer. Discourse gives you 100 percent student participation and real-time assessment. It allows you to ‘look over each child's shoulder’ and gain unparalleled insight into each student's comprehension.”^[3]

Ideal Learning Environment: Each student in the classroom works independently and silently, interacting with his/her own wireless computing device as questions are presented from the keystrokes of the teacher on his/her computer. As students have questions or respond incorrectly, the teacher can either explain a correct answer to the entire class or individually to a student. Assessment can take place much more

frequently than in a traditional classroom setting, and results can be used for remediation as needed.

VISION 3: PAPERLESS CLASSROOM MANAGEMENT

Electronic databases of student information, combined increasing numbers of families with home access to the Internet, offer the promise of providing parents with immediate access to dynamic student information. Different types of student information can be available and manipulated electronically. These can include:

1. Attendance data
2. Teacher lesson plans
3. Student information system data (enrollment information: emergency contact numbers, transcript of past grades, etc.)
4. State assessment data for individual students

Characteristics: Rather than using paper forms to record absences, lesson plans, or assessment information about students, teachers use electronic tools. These may include handheld computers and specialized software solutions. Student information databases may be web enabled, allowing authorized administrators, teachers, and parents to log in and view data about groups of students and individual students using a web browser.

Assumptions: By keeping electronic records of student performance, attendance, etc., both teachers and parents can be better informed about past/current student behavior and academic performance. Discipline management options for students who transfer campuses, especially during the school year, may be enhanced because a more detailed electronic archive of past incidents and administrative actions is available. In our era of expected immediacy, parents as well as students appreciate prompt feedback from educators: including attendance, grades following an academic term, standardized tests, etc.

Examples: Media-X (www.media-x.com) offers the ePrincipal software solution for classroom teachers and administrators. This solution can be integrated with a district's student information system to provide "complete school and district analysis of student achievement." Teachers can use handheld computers (with eTeacher software) to electronically document their standards-based curriculum planning, assess student performance, and report on that performance to the administrator and parents. Administrators can use eVal software to electronically document their formal teacher assessments as well as informal walk-throughs.

Parents can access data about their children in the district through the MxWeb application, using a web browser on their home or work computer and district provided login credentials.

Ideal Learning Environment: The learning environment is not necessarily defined by the use of paperless classroom management tools. Taking attendance with a desktop computer or handheld computer rather than posting a paper note outside the classroom door does not require any fundamental changes in the learning environment. It may be more convenient for parents and teachers to have attendance, assessment, transcript, and other data at their electronic fingertips, but this access does not necessarily require or encourage instructional changes or models.

VISION 4: A LEARNING ENVIRONMENT DEFINED BY AUTHENTICITY

The classroom of the twentieth century was defined predominantly by textbook learning. In the twenty-first century, sources of information are increasingly electronic and diverse. Use of handheld technology in the classroom offers potential for students to engage in learning activities with authentic content, using authentic tools, in communication with an authentic audience. Like vision #2 previously mentioned, student engagement is heightened within this vision by the fact that every classroom participant has his/her own handheld electronic device. Unlike vision #2, however, students do more than respond to teacher-directed assessment questions with their handheld. Students access information, take notes, create electronic concept maps, write articles for email exchange and web publication, and consistently engage in collaboration with their classmates as well as teacher.

Characteristics: Each child has his/her own electronic device: either a handheld computer, keyboarding electronic appliance, or full-blown laptop computer. The classroom is regularly abuzz with the sounds of collaborative student learning. Students engage in peer editing and produce collaborative electronic products. Some are printed for display in the classroom, others are shared with classmates during student presentations, others are shared online via email and webblogs. Students regularly evaluate the validity of electronic information obtained online, and utilize print materials from the library as well as digital texts. Whole-class mini lessons provide daily opportunities for the teacher to present information and discuss ideas with the entire class, while individual and group conferences allow the teacher to monitor student progress on a variety of independent investigations.

Assumptions: Literacy is a broad concept that goes beyond traditional textbook based learning. Students learn best when they are engaged with authentic content for which they have schema (prior knowledge and experience.) Learning is an essentially social and experiential process. When students publish for an authentic audience (not just the classroom teacher), intrinsic motivation and attention to detail increase. Students must learn to use authentic digital tools in the classroom of today to prepare them for the workforce of tomorrow.

Examples: Mr. Tony Vincent's "Planet Fifth" website, documenting the activities of his fifth graders in Omaha, Nebraska, provides an example of a classroom where handheld computer use is ubiquitous and students learn in an environment rich with authenticity of many types. One example is "The Daily Planet" reports by students in his classroom (www.mpsomaha.org/willow/p5/log/log.html). Using their handheld computer and a digital camera accessory, students record the major activities of their day with prose and still photography. This documentation is subsequently published for a global as well as local audience on their class website. Mr. Vincent's "Learning in Hand" website (www.mpsomaha.org/willow/p5/handhelds/) documents many of the techniques and tools he and students utilize in the classroom with handheld computers.

Handheld software originally developed with National Science Foundation grant funding at the University of Michigan's Center for Highly Interactive Computing in Education (HI-CE) is being utilized in classrooms across the United States with this final vision in mind. These programs include PicoMap (concept mapping), Sketchy (visual representation and simulation/animation tool), and FreeWrite (word processor). These software solutions (previously freeware) are now available commercially through GoKnow (www.goknow.com). Excellent videos about the use of these tools are available on <http://palm.hice-dev.org/media.htm>. Further examples, including secondary classroom examples, are available on Apple Computer's "One to One Learning" website (www.apple.com/education/onetoone).

Ideal Learning Environment: Both teachers and students are engaged in an ongoing learning process, in which content area and technology skills are embedded in lesson activities. Classroom instruction is primarily student-centered, but the role of the teacher is vital in guiding and facilitating learning, as well as helping assess student work. Assessment is authentic and ongoing. Expectations of student performance are extremely high.

Technology tools are used transparently throughout the curriculum by students as well as teachers to support the learning environment. Classroom work is characterized by a buzz of activity, a high level of intrinsic motivation, and a spirit of discovery as well as a love of learning on the part of all participants. Students demonstrate mastery of required knowledge and skills through a variety of assessment options. Authenticity of content, tools, audience, and assessment prevails.

TOWARD WHAT END?

When considering different potential uses of handheld computers in the classroom, all educational stakeholders need to begin by asking fundamental questions. What vision of teaching and learning will be supported by the purchase and implementation of this new technology solution? Does this vision complement or compete with the existing vision of teaching and learning which our classroom / school / district embraces? The individuals answering these questions must NOT be limited to the “techies” working for hardware and software companies, eager to peddle their wares to schools of every flavor. EDUCATORS need to provide answers to these questions, and if necessary, help provide a guiding vision for these and other potential purchases.

Research on CERTAIN USES of handheld computers in the classroom provides reason for both optimism and excitement. Research from SRI published in September 2002 indicates the following:

- 93% of teachers believe handhelds have a positive effect on learning.
- 75% of teachers who let students take Palms home report an increase in homework completion.
- 72% of teachers said handhelds are easier to integrate into classroom activities than desktop computers.
- 89% of teachers said handhelds are effective teaching tools.[\[4\]](#)

The purpose of this article is not to reject out of hand any specific technology products or vendors. Rather, the purpose is to offer a challenge to educators everywhere to define our visions for teaching and learning, and inform the visions of our classroom peers and administrators! At the dawn of the twenty-first century, educational technology evangelists should not merely seek digital toys which make instruction flashy and more appealing to students, like a slick PowerPoint with digital video clips. The question we should be asking is: How can we use instructional technology to positively transform teaching and learning environments, to prepare students and teachers for the twenty-first century?

The answer may turn out, literally, to be in the palm of our hands.

Wesley Fryer is the father of three children, including a six year old who competently uses a Gameboy, a Leapad, and his father's castoff monochrome Palm IIIX. Handheld computing devices already figure prominently in the lives of his children, and seem destined to play an important role in their formal educational careers also. Several of Wesley's presentations about handheld computers in K-12 classrooms are available on www.wtvi.com/teks/handhelds.

This article was written in November 2003.

[1] Soloway, Elliot. HI-CE Video: "Stories from the Classroom." http://palm.hice-dev.org/movie/palm6_18.MPG. Accessed 29 November 2003.

[2] Jukes, Ian. Presentation at the Texas Computer Education Association Conference. 6 February 1998. www.ianjukes.com.

[3] "About Discourse Software." <http://www.ets.org/discourse/about.html>. Accessed 29 November 2003.

[4] Joyner, Amy. "A Foothold for Handhelds." American School Board Journal: Special Report. September 2002. <http://www.asbj.com/specialreports/0903SpecialReports/S3.html>. Accessed 29 November 2003.

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