# Two Teachers Implement One-to-One Computing:

# A Case Study

Maine Learning Technology Initiative

Research Report #5


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Research question: Given ubiquitous computing, how do teachers use computers in constructing curriculum and delivering instruction?

In 2000, Maine's Governor announced a bold plan to make students in the state technologically literate. A task force was convened to study the concept, flesh out the vision, and address the barriers to the aims of the Maine Learning Technology Initiative (MLTI). Their vision was even bolder:

> Our schools are challenged to prepare young people to navigate and prosper in this world, with technology as an ally rather than an obstacle. The challenge is familiar, but the imperative is new: we must prepare young people to thrive in a world that doesn't exist yet, to grapple with problems and construct new knowledge which is barely visible to us today. It is no longer adequate to prepare some of our young people to high levels of learning and technological literacy; we must prepare *all* for the demands of a world in which workers and citizens will be required to use and create knowledge, and embrace technology as a powerful tool to do so.
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> State of Maine, 2001, p. i.

The implementation of MLTI unfolded very swiftly, and the Maine Education Policy Research Institute was poised to evaluate the project on a statewide basis. The Institute offered a few grants for researchers who wished to study a slice of this innovative initiative. Since teachers can act as gatekeepers for student achievement, two faculty members at the University of Maine carried out a year-long case study, focusing on two teachers using the MLTI laptops. This research brief describes the study, which took place during 2002-2003, and is in the process of publication by the authors.

Hillside Middle School is located in a rural area, not too far from the state university. (Except for the name of the state, pseudonyms are used.) When the study took place, Hillside housed approximately 380 students in grades six through eight. Across all subjects, for three years, the average school scores for the state standardized tests were remarkably close to the state averages.

The researchers used an iterative data analysis technique, which involved the transcription of audiotapes, and the coding of artifacts, observations, and interviews. They used inductive analysis in summarizing the data. Although the paired participants were "samples of convenience" they provided an intriguing look into how teachers worked with one-to-one computing. Rick, a science teacher from Hillside Middle School had just finished a master's program in instructional technology. He graciously offered to allow the researchers in his classroom. Susan, the other seventh grade science teacher, also welcomed us. These two excellent teachers illustrated two distinct approaches to using the laptops in their teaching.

Susan and Rick believed in the potential power of ubiquitous computing. They both spent the pre-MLTI spring and summer on the school's technology committee planning for integration of laptops into the course curricula. The first year with the MLTI laptops was Susan's fourth year as a science teacher and Rick's fifth in both sixth and seventh grades.

Three themes surfaced in this case study: the effect of technological issues on instruction, the tensions between time constraints and other teacher expectations, and the educational impact of various policies. The full study report contains details, further examples, and additional background information. Examples of both teachers' laptop lessons are listed in the appendix.

***Technological Barriers***

Susan was a planner. When her class embarked on a new project, she carefully clarified expectations, explained the underlying rationale and addressed potential problems. Consequently, when glitches occurred, such as the students' inability to access the school server for a specific purpose, her plans were affected. Susan's calm manner and quick thinking would save the immediate lesson, but at the end of the day, she would feel discouraged about how things went and was less likely to plan a similar activity. The impact of technical issues on teaching is not surprising and has been highlighted in other studies (Hill, Reeves, Wang, Han, & Mobley, 2000; Sandholtz & Reilly, 2004)

However, Rick did not appear to let technological glitches exert a great affect on his *modus operandi*. He tended to roll facilely with whatever technical punches were dealt him. For example, when Rick's students used a website describing a biological cell with some broken links to descriptions of organelles, he asked them to find those organelles in their textbook. Alfred North Whitehead (1949) might have described Rick's ability in responding to unanticipated technological problems as "style:" achieving the teaching of things without

inefficiency and distraction. "It is an aesthetic sense, based on admiration for the direct attainment of a foreseen end, simply and without waste" (p. 153).

***Time Versus Expectations***

"Lack of time" is a common reason that teachers give for are not integrating technology more thoroughly into their classroom (Riel & Fulton, 2001). Susan's emphasis on being super-explicit with her students, both about curricular concepts and laptop policies, sometimes prevented the full implementation of laptop activities she had planned. Because she targeted high quality educational resources, finding the "perfect" website ate up an extraordinary amount of her planning time.

Additional drains for Susan were the statewide initiatives concerning the *Maine Learning Results* (standards) and the required construction of the Local Assessment Systems. She took these expectations seriously and felt that they siphoned away time and energy from more innovative laptops projects.

Throughout the planning stages and during the first year of MLTI, Rick employed his master's degree in instructional technology and generated many possible ways that he could use laptops in his classroom to make student learning more active, student-constructed, and relevant to the students' real-life experiences. Some of these ways he was able to implement during the first year, and some he had to table for future use.

Rick's troubleshooting and computer skills helped him to ameliorate some of the time consuming technical problems. Furthermore, Rick shared responsibilities for documenting MLR with his students.

***Policies***

The third critical impact on teaching with the laptops derived from policies from the seventh grade team, the school, and the state. These took various forms, which are explicated in the full report. An example of an effect derived from a team policy can be seen in the decision to disconnect the network on the laptop of any student who had an Internet "violation." This created a burden for teachers committed to involving all learners in activities. Susan spoke on numerous occasions about having to create dual lesson plans and providing double the resources: hardcopy as well as online material.

The school policy not to allow laptops home without a parent's signature interacted in a more complex way with teaching and learning. The researchers saw this as unintentionally

undermining digital equity—one of the foundational purposes of MLTI. Although the school had gone to great lengths in offering to cover the annual $30 insurance free, some parents did not want their children to have the responsibility of having a computer at home. The students whose parents refused to sign the permission form tended to be the students who would have especially profited from extra time using the laptops.

Susan clearly held high standards for her students and was committed to quality learning for her students. As the year progressed, the researchers saw that Susan designed and implemented activities in which her students used the laptops in ways that enhanced how she had taught science the year before. Rick was also clearly committed to quality learning for his students. Rick tended to have students use the technology for activities that he hadn't attempted previously.

***Conclusion***

This study highlighted the journey of two teachers striving to do their best. The researchers suggest that these teachers' responses to the themes of technical limitations and glitches, time constraints and the effects of policies under which they worked are fundamentally a matter of teacher priorities, and that these priorities are ordered consciously or unconsciously by philosophical beliefs about teaching and learning.

One teacher, Rick, had been prepared by his academic education and his teaching values to instruct in a student-centered manner. For him, the laptops were a teaching and learning tool that he could use to put even more learning power and control in the hands of students, a tool he had been anxiously awaiting. The other teacher, Susan, seemed to see the laptops reaffirming her understanding of the respective roles of the teacher and the student.

It's possible that laptops may provide the impetus for fundamental change as some researchers suggest (Fairman, 2004; Rockman, 1998). Janet Fairman asserts in her report, "The most intriguing point about the early results of Maine's laptop program is that the changes in classroom roles, teachers' pedagogical views, and practice were both rapid and dramatic" (p. 33). However, our case study seems to show a more complex picture in which Susan and Rick have not drastically changed their pedagogical strategies, yet students in both classrooms are learning in fertile environments that allow them to construct scientific meaning. Laptops have an educational place in both classrooms, even though they are pedagogically situated differently.

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## SELECTED EXAMPLES OF LAPTOP USE

### Rick

*Website on the biological cell:* When planning for the study of the biological cell, Rick remembered a website that compared a cell's organelles and their functions to those of a city (Cell City, http://www.nasa.learn.com/re_wq_acellisasmallcity.htm). He allowed his students to access the website with their laptops to learn the organelle functions. Then the student teams designed and made physical models of human organizations to which a cell might be compared (e.g., a factory).

"*Acceleration due to gravity" activity:* Student teams dropped clay balls from different measured heights and timed their falls with stopwatches. Each team entered its data into a member's laptop spreadsheet, and then graphs average velocity vs. time of fall. The data and graphs were evidence of acceleration of the balls.

"*Mean Student" unit:* The first week of school, Rick's students each measured their height, arm span, and foot size. Student teams entered the data into laptop spreadsheets, and then shared their data with other teams. They calculated the class average for height, arm span, and foot size and then decided which class member had measurements closest to the averages (i.e., was the "Mean Student"). The class predicted who would be the "Mean Student" in the spring. Then, in late spring, the class members again measured these quantities, calculated their individual growth, and determined the new "Mean Student."

*"Maine Learning Results math performance indicator skill"* unit: Rick's students each picked a math skill that is described in a *Maine Learning Results* performance indicator that the student felt he or she had mastered. Each student then created a "real-life" problem and solution that used that math skill, and described them using a laptop word processor.

**Susan**

*Replacing sections of the outdated science* text with websites geared toward the *Maine Learning Results* and the reading ability of her students.

*WebQuest on the circulation system:*

Susan used an inquiry-based project (WebQuest) to introduce the students to a new unit. Although the WebQuest contained a quiz, Susan didn't see this as an assessment opportunity. In her eyes, it was an awareness activity that would lay groundwork for the following week when they would become more involved in the unit.

*Math Homework*

Shaking her head in amazement, Susan expressed surprise that she saw math work done on the laptops by students who ordinarily wouldn't bother to do it with paper and pencil! Her surprise was due to the difficulty of writing fractions in a word processing program. She noted the motivational aspect that students had about using the laptops and believed that it kept students more organized.

*Invention Academy Graph*

Susan structured this workshop to begin with paper and pencil practice with graphs. As students understood the underlying concepts, they transferred the graphs to the computer. Once the students began to use the graphing capabilities of *AppleWorks,* Susan noted an interesting change in the students' willingness to revise.