Laptops in the classroom: Implications for practice

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Maybe your district is embarking on a laptop program in the near future. Maybe you have read "war stories" of teachers involved in a one-to-one implementation at their school. Maybe you have heard about Nicholas Negroponte and the One Laptop Per Child initiative, a plan to put $100 laptops in the hands of every child in the developing world.

Chances are if you are a K-12 educational professional, you have had some contact with the idea of providing students with full time, one-to-one access to computers by issuing laptops to everyone. This is the one-to-one laptop experiment.

The truth is that these are exciting times for the champions of technology in education as more and more schools join the one-to-one laptop experiment. At the same time, innovative educators must allocate their limited resources carefully. High priced innovations draw resources away from other often proven programs. Policy makers must have good justification for these new investments.

The good news is that if your school or district is planning a one-to-one implementation, the evidence of ten years of laptop initiatives is available to guide your decision-making. In this article I will outline the lessons learned from ten years of K-12 one-to-one laptop programs and explain how these lessons can be incorporated into your plan for successful one-to-one computing. The article is divided into four sections:

- What is a one-to-one laptop initiative?
- The nature of the evidence.
- Lessons learned from ten years of laptop programs.
- Implications for practice.

What is a one-to-one laptop initiative?
One-to-one laptop initiatives provide students with internet access and laptop computers for use at school and home. Decreasing costs, increased portability, and availability of wireless networking all contribute to making broad implementations feasible (as documented in Apple Computers, "Research: What It Says About 1 to 1 Learning," 2005; and William Penuel, "Implementation and Effects Of One-to-One Computing Initiatives: A Research Synthesis," 2006). At the heart of this interest is the belief that increased ac-

cess to technology will lead to increased technology use, which will in turn lead to improvements in a variety of educational outcomes (Russell, M., Bebell, D. and Higgins, J., "Laptop Learning: A Comparison of Teaching and Learning in Upper Elementary Classrooms Equipped With Shared Carts of Laptops and Permanent 1:1 Laptops," 2004).

Since the late 1990's these laptop initiatives have appeared across North America and around the globe in various configurations, from small private school implementations to state-wide deployments. Fortunately, the evaluation reports of many of these programs are publicly available. After ten years of laptop programs educational planners and policy makers can learn from this wealth of experience when designing new implementations.

Lessons learned from ten years of laptop programs
I have drawn on the experience of a variety of different laptop implementations, from small private schools to huge statewide initiatives. Even though these programs differ in many aspects, several common findings were reported.

1   Laptops are the cure-all of educational innovation (we hope!): The goals of these laptop programs were extensive and included: increasing technology use by students, teachers and administrators, increasing student and teacher technology literacy, improving quality of teaching and learning, reduction in dropout rates/improving attendance, improving motivation and behavior, and improving academic achievement. I was particularly surprised at the breadth of program goals. In the implementation that I studied, the board website lists three main goals and no fewer than twenty sub-goals from improved numeracy and literacy to increased enrollment to enhanced lifelong learning.

2(a)   More technology results in more technology use ... Almost all (88%) the studies reported that the laptop program led to increased technology use. We should not be surprised at this finding - it makes sense that the more that technology is made available to teachers and students, the more they will use that technology. Why bother even set this as a performance goal? As Larry Cuban points out in his classic *Oversold and Underused* (2001) the

Sidebar – The nature of the evidence

The findings described in this article are derived from close to one hundred evaluation studies of one-to-one laptop implementations, as well as six research summaries. I will use this evidence to determine when, how, to what extent, and under what circumstances one-to-one computing programs affect K-12 educational goals such as student achievement, student and teacher technology use, and student and teacher attitudes. I hope that my findings will provide useful new educational professionals considering new laptop implementations.

first computers introduced into classrooms quickly became dust collectors. How could they affect learning if the teachers and students did not use them? Educational professionals learned that technology use could not be assumed and as a result have included it as an explicit program goal.

2(b) ***Or does it?*** Any innovation benefits from a novelty effect: students and teachers are motivated by the newness of the tools or methodologies. When the novelty wears off, students and teachers return to familiar patterns and habits. Laptop implementations may benefit from this novelty effect in the short run, only to see these gains disappear in time. Two studies tracked changes in technology use over time (Stevenson, K. R., *Evaluation report-Year 3: High school laptop computer program (Final Report, for school year 2002/2003)*, 2004; Newhouse, P., Rennie, L., *A longitudinal study of the use of student-owned portable computers in a secondary school*, 2001). As expected, teachers and students in laptop classrooms reported more technology use than in classrooms with shared computers. After the first year of the program, however, technology use patterns declined, suggesting that novelty accounted for at least some of the increase in technology use. It is interesting that both these studies stress the importance of combining the hardware with instructional methods that make use of the advantages laptops have to offer (Stevenson, 2004; Newhouse & Rennie, 2001). Students quickly become frustrated when new technologies are forced into the same old instructional techniques.

3 ***Laptop programs increase motivation and positive attitudes to technology:*** About half (52%) the studies report data on student motivation, all reporting increases over previous levels or over non one-to-one comparison groups. These findings are certainly encouraging even though the actual cause of student motivation is difficult to identify. At the same time, as with technology use, motivational increases may be due to the novelty effect.

In addition, many studies (60%) reported increases in positive attitudes toward technology. Again, of the six studies that describe how attitudes toward technology change over time, three report that differences between the one-to-one and non one-to-one groups declined. Given all these qualifiers, though, one-to-one initiatives have consistently resulted in increased technology use, student motivation, and positive attitudes toward technology.

4 ***Laptop programs can improve technological literacy***: Fewer studies (44%) report increases in technological literacy, though in a few of these cases the reports rely solely on the perceptions of teachers and students. Given the increased use of technology reported in so many studies, I expected more studies to report increases in technological literacy.

5 ***Affects on attendance and discipline are harder to prove:*** Though many one-to-one initiatives listed improved attendance and discipline as important program goals only four studies reported attendance figures. Of these, two report dramatic increases in attendance while the other two report no differences. Similarly, of the four studies report-

ing on student discipline, two report improvements while the other two report no difference.

6 **_Improved teacher-student interaction is an unforeseen benefit:_** Interestingly, though not usually stated as an explicit goal of one-to-one initiatives, nine studies report improvements in the quality of teacher-student interactions. Not only will teacher-student interactions impact motivation and discipline, but these interactions will directly affect the quality of instruction.

7 **_Expected achievement gains did not materialize_**: Ultimately, the success of educational programs is judged by how they affect student academic achievement. All the laptop initiatives list student learning gains as a primary program goal. Fewer than one quarter (23%) report achievement data. On average, one-to-one laptop program students perform no better than they did before the program or no better than non-program students in Language, Mathematics, or Reading. In fact many reports did not even report achievement test scores, arguing that the laptops impacted learning in ways not easily measured by standardized tests.

We need to heed these achievement results. Planners and policy makers were perhaps optimistic to expect that placing computers in front of students would automatically result in achievement gains. Without appropriate instruction, the laptops are no more than a distraction and can actually hinder learning. As a recent New York Times article reports, even when teachers attempt to put the laptops to good use, "the box gets in the way" (*New York Times*, May 4th, 2007).

8 **_Student writing benefits most from the laptops:_** A few studies report significant improvement in student writing (for example, Ross, Steven M. et al., *Anytime, Anywhere Learning: Final Evaluation Report of the laptop program: Year 3*, 2003). Students followed specially designed writing programs designed to take advantage of the capabilities of the laptops. These programs consistently report writing gains, some of them dramatic. Even though for the most part these programs use non-standard measures of writing achievement, this finding is encouraging.

9 **_Professional development is a key to success:_** All studies report that teachers received professional development on technology integration. As with any innovation, professional development will determine the extent to which teachers are able to implement the initiative as intended. While most studies report extensive professional development prior to implementation, teachers need support throughout the life of the implementation. In the laptop implementation that I studied, consistently teachers reported that they wished they could have more in-service professional development. In particular they expressed the desire for workplace training as opposed to more classroom sessions.

10 **_Technical issues threaten program effectiveness_**: The laptops only helped achieve educational goals when they worked as they were supposed to. From major

problems where complete shipments of machines had to be replaced, to minor problems where novice users had difficulty performing simple tasks such as file management, technical challenges impeded program effectiveness. As with professional development, technical support needs to continue for the life of the program.

Implications for practice
We can draw many lessons from ten years of one-to-one laptop initiatives. Here are five ways these lessons can impact your laptop initiative:

1 ***Set appropriate goals.*** Establish clear, realistic goals for your laptop initiative, drawing upon the experiences described above. State how progress towards these goals will be measured and establish measurable benchmarks for success.

2 ***Incorporate instruction that takes advantage of what the laptops do best.*** Be willing to design your instruction specifically with the computers in mind. Simply inserting laptop computing into traditional methods of instruction can even be harmful.

3 ***Don't be afraid to copy what works.*** We have many examples of how laptops can enhance learning. Especially where your goals are similar to those of programs that work, be willing to imitate these success stories.

4 ***Professional development should continue through the life of the program.*** Many programs report extensive pre-implementation professional development and limited in-service support. Teachers report that they would benefit more if this trend were reversed.

5 ***Minimize technical disruptions***. Plan for technical difficulties up front. Provide teachers with continuing technical support throughout the life of the program.

6 ***Plan for change management.*** Involve all interested parties, including teachers, administrators, parents, and students in all stages of program planning, decision-making, and implementation so that a sense of shared ownership and responsibility for success is developed. Identify innovation champions to promote the program on the ground.