Introduction

This study examined one classroom with one-to-one, high-speed, wireless computing. The lessons learned can inform our continued learning. Before we consider the next steps, it is important to consider what this one classroom appears to be teaching us.

7.1 Conclusions

In this one-to-one, high-speed, wireless computing classroom…

…the way students learn is changing:

There is evidence of more mistake making which reflects more risk-taking. There is a greater range and variety of work. Students appear better able to tailor learning to meet their personal learning needs.

…students are changing what they learn:

Access to current, relevant information and resource materials appears to be making a difference – students are more informed, they are learning about different things, and they are showing what they know in different ways.

…the people with whom students learn are changing:

Students are more willing to help each other, to give each other feedback, and to work collaboratively. The number and kind of interactions between students and students, and students and adults are increasing.

…students' personal context for learning is changing:

Students report that they are more motivated to learn and more likely to engage in challenging tasks. They have increased self-efficacy. They see themselves as capable. They spend more time on academic work. Their writing skills are improving. Students report a sense of pride in their accomplishments.

…students are changing the way they think about their learning:

Students are seeking more feedback about their work. They talk about using feedback, from self and others, to guide their learning and to produce better quality work. The students express an *intention* to learn and use feedback to achieve success.

…students are changing whom they interact with about their learning as they are learning:

Students are interacting with a greater range and number of feedback sources (peers, teachers and others). Students show evidence of using criteria to guide their learning and the feedback they give others.

…the context for teaching is changing:

Students assist more in the teaching and learning process. Teaching is more project-based and learning is more collaborative. There is more evidence of student learning, a greater variety of evidence, and better quality evidence of student learning to assess.

…students are changing their ideas about what matters in their work:

Increased feedback from more sources appears to be resulting in more and better quality products. There appears to be a relationship between the explicitness of the criteria used by the teacher, the quality of the teacher's feedback, and the students' ability to give specific feedback to themselves and others.

…the kind, quantity, and quality of the evidence of student learning is changing:

Students are learning different things and learning in different ways; therefore, the evidence of learning is changing. Students show what they know in different ways because they choose to represent what they know in different ways as individuals and as a class. The technology tools at hand in this classroom allow them to do so more effectively. Evidence of learning goes beyond test results.

…the role students have in showing proof of their learning is changing:

The amount of evidence of student learning generated indicates students are able to take more responsibility for collecting, organizing

and showing evidence of learning. Students are beginning to self-reference – to ask, 'Do I know what I need to know?' and 'What proof do I have?' – rather than asking someone else if they have learned. The more practice students have with self-assessment and using criteria, the more their role in assessment is likely to change.

…the role teachers have in showing proof of student learning is changing:

The teacher is *assessing* and *evaluating* more evidence of learning. The teacher is able to access a larger body of evidence and is learning ways to collect, organize, and represent evidence of learning in more manageable ways. External accountability measures such as Maine's Local Assessment System (LAS) and the Maine Educational Assessment (MEA) – designed to inform the allocation of support, resources, and program development - may be even less well suited to account for individual student learning in this context, given the breadth, depth, and variety of student evidence of learning available.

…accounting for individual student learning using report cards with letter grades, District Writing Prompt Scores, Local Assessment System, or Maine Educational Assessment is becoming increasingly problematic:

The amount of evidence of student learning and students' growing ability to reflect on, and account for, their own learning means that students are better prepared to participate more fully in the process of accounting for their learning. While external assessments are limited by nature, they are even more limited in light of what, and how, students are learning in a one-to-one computing environment.

7.2 Recommendations for Continued Implementation of the Goals of MLTI

1. Continue to meet emerging hardware and software needs in support of student and adult learning.

2. Continue to provide support for adult learning. There is a continued need for support from MLTI for teachers, principals, classroom assistants, special educators, and others connected to students' learning in regards to information, knowledge, skills, and networking with colleagues in other schools.

3. Continue to support the principal and technology coordinator so they can work to actively remove barriers and support teaching and learning in a one-to-one, high-speed, wireless computing classroom environment.

4. Continue to support both qualitative and quantitative research that explores the changing context for learning, assessment, and teaching in a technology-rich environment at the student, classroom, school, and system-wide levels.

7.3 Recommendations for Further Research

A comprehensive research agenda uses a variety of research methods to pursue information about the breadth of change and to provide opportunities to understand what is occurring as students learn in a one-to-one computing classroom environment. If the impact of technology on learning, assessment, and teaching is to be understood and better supported, it is essential that both qualitative and quantitative studies be undertaken that represent many different perspectives – many ways of knowing. It is not about finding the 'best' research – it is about gathering a variety of information that can be used to better inform our collective understanding of what is happening, and to provide the information needed to inform decision-making at a variety of levels, from students and teachers in classrooms to legislators in government.

Recommendation #1:

The findings of this report reflect one classroom in their first year of implementation. It is essential that year two and subsequent years of change be recorded and analyzed in order to document the evolution of the change.

Recommendation #2:

Learning, assessment, and teaching are changing in this one-to-one, high-speed, wireless computing classroom. It is important that questions arising from this study be explored in different contexts. The research findings that emerged in this study need to

be used to guide research in other settings. Possible research questions are numerous and varied. The research methods employed also need to be varied. Key areas of possible research areas include:

2a. **Student learning arises from the context in which it takes place. What is the effect of one-to-one computing for different learners in different learning contexts?**

For example: Is the impact similar in other middle school classrooms? In other areas? At other grade levels? In schools where students move from teacher to teacher? In schools that are larger in size? In schools where the community's economic status is different? In schools where there are cultural and language differences? Does it change from subject area to subject area? Does technology limit learning in any subject area?

2b. **Learning proceeds from the learner. In order to understand the process by which people learn, it is necessary to see process as learners see it. How do learners with different needs view one-to-one computing and what impact do they see it having on their learning?**

For example: What about different groups of students? Males and females? High achieving and low achieving students? Students with special needs? Students with discipline issues? Students with different home languages? Students of different ages? Does the technology impact different learners differently? How can technology be used to support learning of all the different kinds of learners – both student and adult? How can the online environment continue to be protected so it is a safe community for students and adults, free of such things as abusive communications and viruses? How do teachers account for the learning that students do online when they don't even know the knowledge exists to be learned?

2c. **Classroom assessment processes vary depending on the underlying beliefs regarding the role of assessment, the skill of the students and teachers, in terms of assessment, and the relationship that exists between classroom assessments and external assessments. How do teachers and students use assessment to support learning and to communicate about learning in the context of external assessments and one-to-one computing?**

For example: What happens in schools where students have a history of being engaged in reflecting on their learning and collecting evidence? Do they engage differently in showing their learning? What happens when teachers involve students in accounting more for their learning? What happens when students communicate evidence of their learning to parents and other community members? How does feedback change? What difference do those changes make? Do students become more able to self-monitor? Do students develop skills attributed to characteristics of life-long learners? How does the variety, quantity and quality of student work change over time?

2d. **Technology assists students to provide evidence of their learning to audiences beyond the classroom. How does the changing role of students in assessment shift, from being assessed to being partners, in the process with significant stakeholders – teachers, schools, and the larger community?**

For example: What does it look like when roles in regard to assessment and evaluation are changed? How might such change be initiated and supported? Is it more possible for some students than others? Is it more possible in some schools and communities than others? What does it look like when students track, and account for, growth towards quality in relation to different curriculum standards? Is it more possible in some subject areas than others? How might the roles of teachers and schools change as students learn the skills needed to assume a greater role in accounting for their learning? What kinds of professional development support educators as they learn more about assessment that supports learning in a one-to-one computing environment? How can technology help account for the breadth of learning?

2e. **External assessments have an impact on learning and teaching. What do external assessments that provide for accountability purposes, while supporting (or at least not interfering with) learning, teaching, and**

assessment in a one-to-one computing environment look like?

For example: What happens when classroom assessment and teacher judgment regarding student learning has a greater role? What happens in years when external assessments are not 'high stakes' for students, teachers, and schools? What does it look like when external assessments reflect the learning occurring in one-to-one, high-speed, wireless computing classrooms? How can technology support accountability while positively impacting learning? How does one-to-one computing change how we view accountability?

2f. **Students are aware of their learning decisions, although they may not immediately understand the significance of them. They direct their own learning, but are influenced by the context in which they learn. When the context is changed to a one-to-one, high-speed, wireless computing environment (with features such as a larger community of learners, access to e-mail, different ways to communicate what is learned and a *protected* online learning environment), what is the impact on learning, assessment and teaching as well as on the learners and teachers themselves?**

For example: What is the role of having e-mail access versus not having access to e-mail? What is the role of laptops going home as compared to laptops not going home? What difference does a protected learning environment have on students as compared to students who can roam the Internet with few restrictions? What is the impact of reciprocal teaching between students and teachers? How does the impact of technology change over time? What can the path of change look like? What is the impact of technology in determining whether that path is restrictive or enabling to learners and learning? Does technology strengthen the learning community of individual classrooms or groups of students? Does the laptop access facilitate peer review and feedback in part because it is not face-to-face critique? How does feedback change? Do students see their feedback as support for others and themselves in terms of the quality of their work?

2g. **One-to-one computing in the world of schools is affected by decisions such as who has access to information, who has e-mail, and who can work with whom. How do the actions and decisions of people in different support roles affect students and their learning? What kinds of decisions lead to more learning and better assessment to support learning? What kinds of decisions lead to better teaching?**

For example: More than students and teachers are affected by the presence of one-to-one computing. What about Principals? Classroom Assistants? Technology Coordinators? Educators who work with students who have special needs? State-level support people? Others? What are the barriers that exist in different contexts? How might they be overcome? Are different kinds of teaching strategies more effective than others? Are different kinds of interventions more supportive of student learning than others? Does it vary from subject area to subject area? What happens when differing levels of professional development are provided? What is the impact on student learning? What happens in schools where classroom teachers, technology coordinators, or school principals are not supportive? What does that look like? What is the impact on learning, assessment, and teaching? Do classroom teachers become more project-based or more constructivist? Or, does a different way of teaching, not captured by current descriptors, emerge?