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A Preliminary Examination of the Relationships Between the Use Levels of MLTI Devices and School-Level Poverty

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The purpose of this Brief is to report the preliminary results of an analysis of the technology use by poverty levels across Maine middle schools.

Across the United States, educational policymakers, business leaders, and school administrators have championed the increased presence of technology in classrooms. Technology provides teachers and students with access to seemingly endless learning opportunities and resources, changing the landscape of *what* and *how* students learn (Warschauer, 2007). However, as the possibilities for teaching and learning enabled by technology have become more apparent, so too have the gaps between high- and low-income students in their access to digital devices and the corresponding skills required to maximize their potential impact (Attewell, 2001; Inan & Lowther, 2010). Many states and districts have adopted innovative approaches to technological integration into schools, including one-to-one device distribution and the expansion of digital curricula. Such programs not only equalize access to digital devices, but also have the potential to extend learning opportunities beyond the traditional classroom.

Over the last decade, Maine has emerged as a leader in creating universal access to technology in schools. As far back as the 1990s, the Maine Department of Education has worked in combination with the Maine state library system to provide high quality internet access to schools across the state. Beginning in the 2002-2003 academic year, the state implemented the Maine Learning Technology Initiative (MLTI), which provides a computing device to each of its middle school students. This one-to-one effort was the first of its kind, although other states have since adopted similar, large-scale strategies to equalize technology access, including Michigan and Texas. Prior to the advent of the MLTI program, there was evidence of major disparities in students' access to digital devices (e.g., computers), high speed internet, and online learning activities across the state of Maine. In order to enhance students' problem solving, communication, and technological capabilities, MLTI provides a digital device and enhanced

instruction to each middle school student, preparing them to thrive in the emerging technology-rich economy. The program distributes the devices and offers administrative support, including professional development offerings. However, it is up to schools and districts to set priorities, communicate expectations, and implement practices to integrate the devices and meet the educational needs of their students and teachers.

The Emergence of a Second Digital Divide: Continuing Difference in Skills and Application

The rise in innovative technology policies, such as the expansion of one-to-one technology solutions, has substantially bridged the gap in students' access to digital devices. However, a second gap in digital use and proficiency has emerged that highlights the continuing impact of socioeconomic status on creating engaging learning opportunities. Attewell (2001) defines the "second digital divide" as "[the] unequal outcomes [that] may stem from differences between affluent and disadvantaged students in what they do with the technology, once they have access" (p. 256). Understanding the emergence of the second digital divide is important because, as Warschauer (2007) writes: "technology does not transform learning and literacy by itself, but only in conjunction with other social and economic factors" (p. 42).

Evidence of a second digital divide have emerged in a number of empirical studies, suggesting that providing technology solutions without the necessary infrastructure to support their implementation and use does little to resolve issues of equity. For example, Hohlfeld and his colleagues (2008) found that high and low SES schools with similar digital resources demonstrated significantly different levels of student access to technology in various phases of technology integration and use. Additionally, Warschauer and his colleagues (2004) found that low income schools had limited personnel to support their use and maintenance as compared to high income schools. The authors also identified differences in school-wide investments in technology integration and development, such as professional development, technical support staff, and creating robust support networks. These gaps manifest in significant differences in students' and teachers' access to software, use of different software, and access to overall technical support. Together, these findings highlight the critical role that the socioeconomic context of the school may play in technology integration (Attewell, 2001; Hohlfeld, Ritzhaupt, Barron, & Kemker, 2008; Holden & Rada, 2011; Warschauer & Matuchniak, 2010).

Among students, the research suggests that mastery of the myriad skills required to

maximize students' effective use of the devices culminates from diverse support from peers, teachers, and family members, who collectively help individual students to develop particular skills and expose them to diverse approaches to applying those skills (Warschauer & Matuchniak, 2010). Despite evidence of the social aspect of technological skill development the majority of scholarly efforts to date focus on the individual level skills. In combination, these studies point to factors such as differences in teachers' technology skills and their general motivation to integrate the technology into their curricular and instructional practices (Holden & Rada, 2011). Differences in both digital access and application have a meaningful impact on how technology is used with students. Warschauer and Matuchniak (2010) identify the importance of using technology in the classroom not only to encourage the completion of rote activities, such as word processing and research, but also to aid in the development of higher order skills, such as "abstraction, system thinking, experimentation, and collaboration" (p. 181). The authors point to meaningful differences between low- and high income students in how often they engage with such skills.

Finally, a number of studies have sought to understand the mechanisms of continued inequality in how technology is leveraged to extend teaching and learning experiences, and where existing gaps remain. Warschauer (2007) found that teachers in high income schools were more likely to use digital devices in their classroom to encourage critical thinking and information literacy than teachers in low income schools. Collectively, the emergent research surrounding the second digital divide suggests the need for an enhanced understanding of how digital devices are used with and by students and teachers in different types of schools and communities.

After more than ten years of implementation, the evidence indicates that the MLTI program has effectively eliminated the gap in students' *access* to digital devices in middle school. However, even with the universal deployment of digital devices to Maine middle school students, there is considerable evidence that the ways in which teachers and students integrate technology into the classroom varies widely across the state. As MLTI extends into its second decade of operation, a number of questions have emerged that require increased attention to ensure that the needs of students and teachers are being met. For example: Is there evidence of a second "digital divide"—one of skills and use—across the state of Maine? Does the socioeconomic status of students and schools in Maine influence the level of technology integration? The purpose of the

present Brief was to explore these questions. To accomplish this, we examine how students' use of technology varies by schools' free and reduced priced lunch (FRPL) by analyzing data from student surveys that documented how devices were used for educational tasks inside and outside of their classrooms.

Differential Technology Use by Poverty Status

Since MLTI's inception, the Maine Education Policy Research Institute (MEPRI) at the Center for Education Policy, Applied Research, and Evaluation at the University of Southern Maine has been responsible for conducting research and evaluation on the program. In order to assess the perceived effectiveness and impact of the program, MEPRI has gathered data from multiple stakeholders of the MLTI program across the state, including students, teachers, and administrators. For the present Brief**,** we examined data from student surveys collected during the 2010-2011 academic year. The primary goal of the student survey, used over multiple years of the implementation of the MLTI program, has been to get a longitudinal sense of students' level of comfort with and use of the MLTI devices both in and out of school.

The analysis in this study was conducted in several steps. First, we developed a definition of poverty status to be used in the study. The statewide rate of poverty in the state of Maine was 44% for the 2010-2011 school year. For the purpose of this exploratory study, Maine's middle schools were divided into three groups: Lower poverty schools (FRPL=0-33.33%); Average poverty schools (FRPL=33.34-66.67%), and Higher poverty schools (FRPL=66.68-100%). Second, we analyzed survey responses of students in the Higher (n=733) and Lower (n=382) poverty schools, according to our poverty classification. Table 1 shows the demographics of the selected sample.

Table 1: Sample Demographics

School Poverty Classification	Number of Students/Schools
Lower Poverty (FRPL =0-33.33%)	382 (21 schools)
Higher Poverty (FRPL =66.68-100%)	733 (33 schools)

Third, we compared student survey responses for students in the two school poverty groups. In the following sections, we highlight our findings, focusing exclusively on the Higher and Lower poverty schools.

MLTI Laptop Technology Device: In-School Use

On the 2010-2011 survey of middle school age students, students were asked to assess how often they used their MLTI devices to complete work for their classes. Specifically, students were asked, **"This year *at school,* how often did you usually use a computer to complete work for each class listed?"** Using a Likert scale that assessed use from zero hours (1), 1-3 hours per week (2), 4-6 hours per week (3), or seven or more hours per week (4), respondents were asked to provide a unique response for the disciplines of Language Arts, Math, Science, Social Studies, Foreign Language, Art, Music, Technology, and Health. For the purpose of this report, we focus on response averages for four disciplines— Language Arts, Math, Science, and Social Studies.

As shown in Table 2, the data demonstrate mixed results across disciplines. When examining the means of students' reported in-class use of the laptops for Language Arts, students enrolled in *lower* poverty schools used their devices at about the same rate as their peers who attended *higher* poverty schools (e.g., 3.52 vs. 3.49). In the case of Science and Social Studies, students who attended *lower* poverty schools reported using MLTI devices with significantly higher frequency as compared to their peers attending *higher* poverty schools. For Science, the average frequency of use was 3.41 in lower poverty schools, as compared to 3.12 in higher poverty schools. In Social Studies, the average frequency of use was 3.43 in lower poverty schools, as compared to 3.15 in higher poverty schools. Interestingly, levels of use were reversed in Mathematics. Students in *higher* poverty schools reported using their computers significantly more in Mathematics (mean=2.92) than their cohorts in lower poverty schools (mean=2.75). These variations across disciplines suggest that students' experiences with the frequency of technology use in the classroom may be influenced, in part, by the nature of the discipline. However, additional research is needed to gain a better understanding of the reasons for these variations.

Table 2: Student Reported Frequency of Use of Computers by Discipline (2010-2011)

(1 = 0 hours per week; 4 = 7+ hours per week)

Academic Discipline	Lower Poverty Mean (SD)	Higher Poverty Mean (SD)	Significance
Language Arts	3.52 (.76)	3.49 (.78)	p=.655
Mathematics	2.75 (.83)	2.92 (.84)	p=.002*
Science	3.41 (.80)	3.12 (.77)	p=.000*
Social Studies	3.43 (.80)	3.15 (.78)	p=.000*
	**Denotes statistically significant differences*		

Additional differences in students' in-school use of MLTI devices became more discernable when we examined the types of technology-related activities in which students engaged. In addition to assessing general in-school use by subject, the surveys asked students to assess the frequency with which they engaged in a variety of specific activities. Table 3 presents the questions included on the student survey and reports the differences in response by school-level poverty classifications. Students responded to each question on a six-point scale: never (0), less than once a week (1), once a week (2), a few times a week (3), once a day (4), or often during the day (5). Scores were averaged for the analysis.

The analysis revealed significant differences in use levels by type of school for five of the eight items. The data reveal that there is no significant difference by school poverty status in how students use the MLTI devices for basic classroom tasks, such as gathering information (Item 6), looking up quick facts for class (Item 8), and even critiquing websites (Item 7). However, there are significant differences evident by school poverty status for a range of activities that are often mentioned as critical 21st century skills, including skills of interdisciplinary learning (Item 1), problem-solving (Items 2 and 3) and creating new knowledge (Items 4 and 5). The data indicates that students in more affluent schools and communities are performing these activities more often using technology than their counterparts who attend higher poverty schools.

Table 3: Students' In-School Use of MLTI Devices by Activity

(*1= once a week; 5=often during the day)*

Question	Category	Lower Poverty (SD)	Higher Poverty (SD)	Significance
1. Learn things from more than one subject at the same time (e.g., math and science) where you use your laptop as part of a project.	Digital learning	3.31 (1.54)	2.98 (1.54)	p=.001*
2. Use your laptop to help explain your problem-solving process or thinking to your teacher or classmates.	Problem-Solve/Present	2.78 (1.50)	2.50 (1.43)	p=.004*
3. Visually represent or investigate concepts (e.g., through concept mapping, graphing, reading charts)	Produce	2.62 (1.46)	2.31 (1.38)	p=.001*
4. Use a computer to create a graph, table or chart as evidence in explaining your point of view to your teacher or classmates.	Produce	2.57 (1.44)	2.32 (1.38)	p=.009*
5. Create a product with incorporated text or graphics for class assignments.	Produce	2.97 (1.52)	2.58 (1.50)	p=.000*
6. Use a computer to gather information from multiple websites to solve a problem	Research	3.68 (1.50)	3.54 (1.53)	p=.144
7. Use your laptop to critically analyze data or graphs obtained from the media (newspapers, TV, etc.) for understanding, truthfulness and/or persuasiveness.	Research	2.57 (1.50)	2.42 (1.43)	p=.110
8. Use my laptop/computer to look up quick facts for class or research.	Research	4.05 (1.48)	3.89 (1.56)	p=.093

**Denotes statistically significant differences*

MLTI Laptop Technology Device: Out of School Use

In addition to expanding students' access to digital devices during the school day, an underlying goal of the MLTI program has been to provide students with the opportunity to use them to engage in learning activities outside of school. In the 2010-2011 surveys students were asked, **"How often did you use your laptop/computer at home each day for school work?"** Students answered on a Likert scale from never (1) to more than 3 hours (4). Results from this analysis may be found in Table 4. Similar to in-school use, the data reveal that students who attend lower poverty schools use the devices for significantly longer amounts of time on school work outside of the standard school day.

Table 4: Students' Out of School Device Use (2010-2011)

School Poverty Classification	Average Use	
Lower Poverty	3.27 (1.08)	p=.000*
Higher Poverty	2.91 (1.39)	
* *Denotes statistically significant difference*		

Unfortunately, we have little information from the survey to describe how students were using the devices or to otherwise illuminate why these differences may exist. These findings thus lead to several other questions. For example, are students in more affluent schools given more homework for which they must use their MLTI device? Do teachers at lower poverty schools expect students to learn more independently than their counterparts in higher poverty schools? Are there additional obstacles that students who attend higher poverty schools face outside of school that preclude their use of the device (e.g., lack of access to reliable internet)? Additional research is needed to help practitioners and policymakers to better understand the reasons for the differences.

Discussion

The rise of technology in schools opens the doors to extensive teaching and learning opportunities for all students. However, evidence from some studies suggests that technology integration is not as strong in higher poverty schools as in more affluent schools. In the present brief, our findings mirror those of other studies, such as those discussed above. Our data suggest that even though the MLTI program provides all seventh and eight grade students and a substantial proportion of high school students with access to a technological device to enhance their learning experiences, students may still experience Attewell's "second digital divide." In addition to evidence of discipline-based differences in the observed frequency of use of MLTI devices detailed in this report, middle school students in Maine who attend more affluent schools are more likely to use technology to execute higher order learning skills—such as collaboration, informational synthesis, and presentation—that reflect the primary goals of MLTI. In contrast, students who attended schools with higher proportions of students qualifying for FRPL were less

likely to use the MLTI devices to perform 21st century learning strategies; instead, the devices were used routinely for basic tasks such as research and word processing.

Combined, the findings summarized in the present Brief suggest important differences in the frequency and application of MLTI device use between lower and higher poverty schools across the state of Maine. Although the goal of MLTI is to equalize access to digital devices and expand learning opportunities for all students, there is evidence that students' experiences vary by the poverty status of schools they attend. This study was an exploratory one, leaving several questions for future exploration. Our findings suggest that the topic of differentiated learning opportunities using technology is in need of further research, not only to document in more detail the differences but also to explore the reasons for these differences.

With its MLTI program, Maine has been a trailblazer in policy-level efforts to increase access to technology devices for all students independent of their socioeconomic status. However, *how* teachers and students use these tools will determine if all Maine's middle school age students have equal opportunities to learn 21st century skills through technology. Several questions remain about both the quality and quantity of use of the MLTI devices that may have a meaningful impact on students' experiences and subsequent learning outcomes.

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