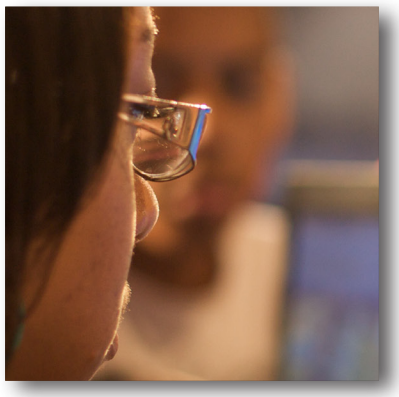

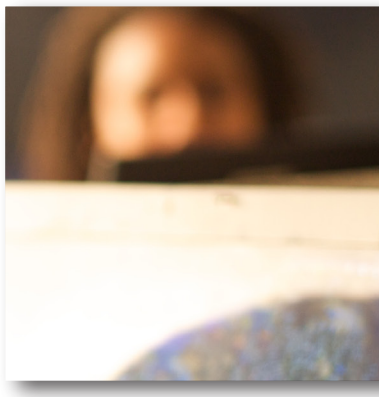

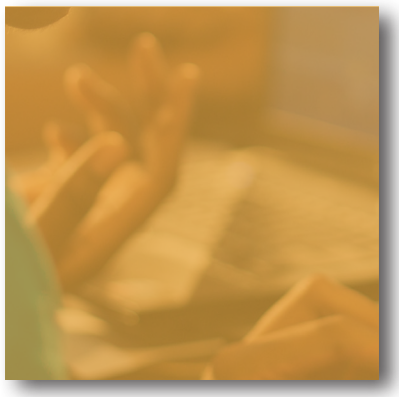
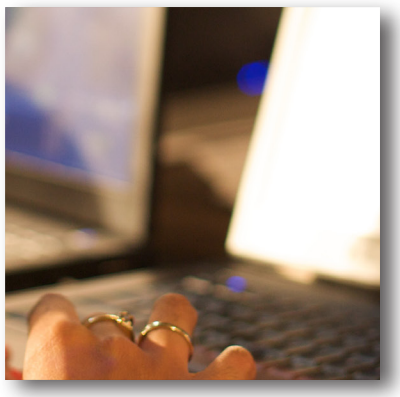

brief

CASTLE

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WHAT DOES THE RESEARCH SAY ABOUT SCHOOL ONE-TO-ONE COMPUTING INITIATIVES?

No. 1

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Schools today are given the task of not only educating students with the three Rs of Reading, wRiting, and aRithmetic but also are expected to give students strong backgrounds in science, technology, global studies, and a diversity of so-called "21st century skills" such as critical thinking, collaboration, agility, initiative, oral and written communication, analyzing information, and imagination (Wagner, 2008). Recognizing that we now live in a digital rather than analog world, many schools are implementing one-to-one computing initiatives to help accomplish these academic goals and many others are considering making the transition.

Although the definition of a one-to-one school varies somewhat from location to location, throughout this brief we typically use the most basic definition of a school that provides a take-home laptop computer for every student within some grade span of the school system (e.g., every middle school student or all 11th- and 12th-graders). Accordingly, this brief excludes studies of school computer labs, or mobile phone initiatives, or other similar programs. We are interested only in studies of students who have access to a school-provided laptop at home during the evenings and weekends as well as during the school day. Many educational leaders and policy makers are attempting to weigh the costs versus the benefits of implementing such one-to-one learning initiatives.

A review of the literature regarding one-to-one programs is necessarily concise. Although one-to-one programs are gaining in popularity, they still are a relatively new instructional intervention. Much more research is needed related to the benefits and/or drawbacks of handing every student a robust computing device all day, every day for academic purposes. We have summarized below what we believe we know to date. The first section of this brief analyzes literature pertaining to the impact of one-to-one technologies on student academic achievement outcomes. The second section addresses additional areas that are important for schools and student success, such as student engagement, attendance, and behavior.

EFFECTS ON STUDENT ACHIEVEMENT AND PERFORMANCE AT SCHOOL

Claims have been made that one-to-one laptop initiatives do not have a positive impact on student achievement at school. Some schools have gone so far as to cancel their programs because of lack of evidence of achievement gains (Hu, 2007). Although these failures have occurred, there are many more cases that support the academic benefits of one-to-one computing. Improvements in writing, literacy, science, exam scores, and GPAs all have been noted in various research studies.

Of the core content areas, some of the most substantial academic achievement results of one-to-one programs have been seen with writing skills. The state of Maine, which implemented one-to-one computing statewide in their middle schools in 2002, has seen significant improvement in writing scores on their statewide test (Silvernail & Gritter, 2007). The same study also found that the more extensively students used their laptops, the better they scored.

Lowther, Ross, and Morrison (2003) also indicated positive impacts of a one-to-one program on student writing scores as well as problem solving. The study compared

two groups of students from the same grade levels in the same schools. The control group did not receive laptops and the other group of students had 24-hour laptop access. The study found that those students receiving the laptops demonstrated superior writing skills. Other studies affirm these findings (see, e.g., Bebell & Kay, 2010; Gulek & Demirtas, 2005).

Additional studies observed gains in both writing and literacy skills. One of those studies (Suhr, Hernandez, Grimes, & Warschauer, 2010) analyzed what is sometimes know as the "fourth-grade slump," which occurs as students transition from "learning to read" to "reading to learn." The study found that students in a laptop program outperformed their peers in the control group in literacy response and analysis as well as writing strategies. It is worth noting that the significant differences between groups were much more observable after the second year of the initiative.

> Some of the most substantial academic achievement results of one-to-one programs have been seen with writing skills.

The research on the impact of one-to-one programs on math and science achievement is more limited than it is for writing. One study of a middle school did focus on the impact of one-to-one on science and math achievement (Dunleavy & Heinecke, 2007). The results indicated that students in the laptop program saw a significant increase in scores on their science achievement test when compared with non-laptop peers but there were no significant differences in math achievement. Other research has indicated that greater access to technology can enhance science education for both middle school and high school students (Berry & Wintle, 2009; Siegle & Foster, 2000).

Another group of researchers investigated whether student access and use of laptops in a one-to-one program predicted higher state achievement scores (Shapley, et al., 2006). The strength of the students' access and use of technology was a consistent positive predictor of students' reading and mathematics scores, with students' use of their laptop at home as the strongest implementation predictor of reading and math scores.

Additional studies have looked at student GPAs and other performance indicators. One study compared cumulative GPAs of middle school students at the end of a year with laptops to the year prior when they did not have laptops (Lei & Zhao, 2008). That research reported a marginally-significant increase in average student GPA. The study also found significant gains in students' technological proficiency. Another study (Light, McDermott, & Honey, 2002) found that after two years in a laptop program, students scored significantly better than their peers across all tracks or subject areas.

ADDITIONAL BENEFITS OF ONE-TO-ONE

In addition to the research examining student achievement, researchers have reviewed other areas that have been impacted by one-to-one computing. These impacts fall into a number of various categories, including student engagement, attendance, behavior, and motivation as well as teacher practices.

Research conducted on 44 Texas middle schools displayed positive results in many of these areas for one-to-one schools (Shapley, et al., 2006). The study included 22 control schools and 22 schools that were one-to-one. Nearly 70% of students in the study came from economically-disadvantaged backgrounds. Although most of the schools were rural and very small, about one-third were in large cities or suburban areas. The results of the study were statistically significant on two major indicators of student engagement. First, the study indicated that students attending one-to-one schools were much more satisfied with school than students in the control group. Second, students at one-to-one schools also were sent to the office less frequently and were suspended less than students from the control schools.

Similarly, other researchers (Bebell & Kay, 2010) analyzed the impact of one-to-one on five Massachusetts middle schools. Teacher surveys revealed beliefs that student engagement and student motivation had both increased. Of the teachers who responded to the survey, 83% indicated that "traditional" students were more engaged in the one-to-one setting. It also indicated that 71% of the teachers believed that students were more motivated with laptops. Many other studies also have found an increase in student engagement at one-to-one schools (see, e.g., Bebell, 2005; Metiri Group, 2006; Mouza, 2008; Russell, Bebell, & Higgins, 2004; Warschauer & Grimes, 2005; Zucker & McGhee, 2005). Although many people worry about the distractions that may come with providing students with laptops, student academic engagement may be one of the most substantial benefits of one-to-one computing programs.

A study of the impact of Florida's Leveraging Laptops Initiative also indicated positive results (Dawson, Cavanaugh, & Ritzhaupt, 2006). The study was conducted on Florida's laptop plan that included a primary goal of changing teaching practices through laptop technologies and professional development. The program included 447 classrooms in various subject areas K-12. The biggest changes from baseline to end of year data were seen in increased "high student attention, interest, and engagement and a decrease in the use of traditional "independent seatwork". Other notable differences included greater use of "project-based learning," "teachers acting as coach / facilitator," "cooperative / collaborative learning," "independent inquiry / research," and "high academic focused class time," with a decline in the use of "direct instruction."

A report on one-to-one computing in the state of Indiana revealed that 100% of educators interviewed shared either observational or anecdotal evidence about the success of one-to-one (Lemke & Martin, 2004b). Those results included increased student and teacher engagement, improved academic achievement, and improved attendance. Educators also observed that students developed deeper cross-disciplinary knowledge and more in-depth "21st century skills" development. A state report from Michigan also highlighted some benefits of its one-to-one program (Lemke & Martin, 2004a). That report indicated that student engagement was at an all-time high, attendance was up, and "21st century skills" development had increased. Academic achievement as measured by standardized tests also was on the rise.

Other studies have examined impacts on

teacher behaviors in laptop schools. One study that involved numerous classroom observations found that teachers in one-to-one classrooms spent significantly less time in large group work than teachers who had laptop access only through a shared laptop cart program (Russell et al., 2004). After observing one-to-one programs for 10 years, Rockman (2003) found that teachers in one-to-one schools lectured less and that there was more individual and group project work. Rockman and other researchers also have observed increases in teacher collaboration in one-to-one schools (Burns & Polman, 2006).

DISCUSSION

Most schools have focused on one or more of four outcomes when implementing one-to-one computing (Penuel, 2006). Those goals include improving academic achievement, increasing equity of access, increasing economic competitiveness of a region, and/or transforming the quality of instruction. Although goals of schools may be dissimilar, they are all rooted in a desire to somehow change the current system. Some have even argued that one-to-one laptop initiatives may go further than most other efforts to change schools (Weston & Bain, 2010).

When examining the research related to one-to-one computing programs, it is clear that they have produced a wide range of results. Some schools observed a large increase in writing and literacy, science scores, and/or student GPAs. Other schools found their programs produced increased student engagement, motivation, and attendance or decreased discipline problems. This wide range of results may be due to the fact that many schools have implemented one-to-with with unique visions. The term "one-to-one" simply refers to the access that students have to technology and says nothing about pedagogical paradigms, desired learning outcomes, or other educational practices (Bebell & O'Dwyer, 2010).

Various research has indicated that the effectiveness of professional development has a direct impact on the success of a one-to-one program (Drayton, Falk, Stroud, Hobbs, & Hammerman, 2010; Shapley et al., 2010) This research indicates how important professional development is when implementing one-to-one. Stroud's literature review on one-to-one programs found that most studies focus on the first three years of implementation (as cited in Drayton et al., 2010). The review also revealed that 67% of the one-to-one studies focused on the time period between pre-implementation and the first two years of implementation. That may indicate that more significant results can be expected once schools become more experienced and skilled with one-to-one computing and learning paradigms. Many of the studies in this brief did indicate that greater results were seen after years two and three than were seen after the initial year. Still, many question the value of putting laptops in the hands of every student. Many of those questions relate to the implementation of such programs. They see initiatives where laptops are used relatively infrequently and they see teachers who continue to teach in the same ways as they did before, ignoring many or most of the affordances that accompany regular student access to a robust computing device (Bain & Weston, 2009). Those studies should not be ignored and actually serve as warning signs for districts implementing one-to-one

computing. Many of the flaws of one-to-one implementation can be seen very easily from the studies.

As schools consider moving to one-to-one computing, there are many factors to take into consideration. Teachers and administrators should carefully consider the outcomes that they would like to see and then design their implementation, training, and assessment efforts accordingly. This research brief highlights many of the possible results that can be achieved through one-to-one computing.

As one-to-one programs move from the experimental stage and become more ingrained in regular practice, the research may begin to reveal additional benefits and concerns. Like any wide-scale innovation, adjustments will need to be made to achieve optimal results. At most schools, one-to-one computing is still a very new idea. Many of the results from the new one-to-one programs are very encouraging. It will be exciting to see how results change and improve as these initiatives mature.

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