Article Review Examining the Role of Technology in Education

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Technological advances have revolutionized our society. From the way we communicate with each other to the way we treat disease, technology has, for many, become a tool that is heavily relied upon. In the realm of education, however, technology has largely been a tool that educators use to enhance administrative tasks (such as student information systems) or as a supplement to instruction (such as fact-practice games). According to Cambron-McCabe, Cunningham, Harvey, and Koff (2013) we are now at a point when technology could indistinguishably change the classroom experience for teachers and students, instead of just enhancing or supplementing it. The superintendent, in turn, will also need to develop new skills in order to facilitate this change (Cambron-McCabe, 2013). Superintendents should look to recent research about how educational technology impacts teachers and how educational technology impacts students as a starting point.

**Student Impact**

 There are three interesting points yielded when analyzing the impact of technology integration on students. First, when in a one-to-one environment, which is a label given to a school when the number of student devices is equal to the number of students; student achievement scores tend to increase. Second, students educated in a one-to-one environment demonstrate a higher aptitude for skills like collaboration and communication. Lastly, the largest gains in test scores and skills seem to show up when students use their devices at home in addition to the school setting.

**Student Achievement**

One of the primary goals of any superintendent is to raise student achievement scores. New instructional models, behavior modification programs, and daily schedules are popular initiatives superintendents deploy in order to attempt to affect student achievement scores. It can be difficult to measure the effectiveness of such initiatives. Therefore, superintendents should take notice when research surfaces that does include clear measures of a particular initiative’s effectiveness.

Bebell and Kay (2010) studied the impacts on student achievement of the Berkshire Wireless Learning Initiative (BWLI), which provided one-to-one technology access to all students in five middle schools in western Massachusetts. They found that 7th grade students who participated in the BWLI program performed at their highest historical levels on record for both the English Language Arts (ELA) and Mathematics portions of the MCAS (a Massachusetts state test) during the year when BWLI implementation was at its peak. Similar results were found for 8th grade students in the BWLI programs, who also showed historically high performance on the Science test in addition to ELA and Math. Furthermore, the statistically significant gains that BWLI students displayed were not shown by non-BWLI comparison students.

 Gulek and Demirtas (2005) also measured the impact of a laptop program on middle school students. This study followed 259 students via cohorts. Some of the data collected included student grade point averages, end-of-course grades, writing test scores, and state-mandated norm-referenced standardized test scores. After just one year in the program, laptop students showed significantly higher achievement in nearly all measures, and these gains continued into years 2 and 3.

**Skill Acquisition**

 In addition to achievement scores, students involved in one-to-one programs show or report changes in a number of important skills. Bebell and O’Dwyer (2010) examined five one-to-one schools and found that these students displayed higher levels of engagement and better research skills than their non one-to-one counterparts. One-to-one environments have also reported increases in student interactions, one way of measuring collaboration, and increases in the ability to work independently (Bebell and Kay, 2010). Perhaps more significantly, these gains were reported uniformly by high-achieving, middle-achieving, and low-achieving students in one-to-one programs (Bebell and Kay, 2010).

 Gulek and Demirtas (2005) site research that one-to-one programs yield improved skill acquisition over non one-to-one programs. They found that one-to-one students spend more time working collaboratively with others, produce better writing, have improved research analysis skills, and spend more time doing homework. One-to-one students also engage in problem solving and critical thinking at a higher rate, while displaying flexibility in their uses of technology.

 The skills that students need in order to succeed in work and life are constantly changing (Cambron-McCabe et al, 2013). Superintendents must consider skills in addition to student achievement scores when evaluating school programs and initiatives.

**Out-of-School Access and Use**

 One of the more interesting findings when analyzing one-to-one programs is the correlation between student achievement scores and measures of access and use. Bebell and Kay (2010) found that students who reported using technology more frequently than others in the BWLI program also achieved better scores on Math and Science assessments. Also, the frequency with which students used their devices at home recreationally proved to be a positive statistically significant predictor of ELA and Math scores.

 Other research by Shapley, Sheehan, Malonely, and Caranikas-Walker (2010) revealed similar results, namely that students’ use of laptops outside of school for homework and learning games was the strongest predictor of student achievement scores. Additionally, the level of student access and use of technology was a stronger predictor of student achievement than any teacher-level predictors.

**Superintendent Focus**

 The technology access and use research underscores the importance of truly engaging the community, specifically parents. Not only must superintendents build and sustain support from the community, they must also educate them in order to maximize the results of school initiatives. Additionally, they must consider the ramifications starting a one-to-one program in which school-owned devices are required to stay at school. The research above indicates that poorer students could fall even further behind if their wealthier classmates use family-owned devices at home while they do not. Parents and community members must understand how decisions of such magnitude are made and the reasons behind them. Superintendents cannot realistically rely on community support for such measures unless great care has been taken to engage and connect the community to the school (Cambron-McCabe et al, 2013).

**Teacher Impact**

 Research shows that one-to-one environments have a discernable influence on teachers. This research can serve as a roadmap for superintendents and district leaders to follow when implementing their own one-to-one initiatives. The first level of research focuses on teacher support and training. From there, studies look at the fundamental changes that teachers make in their practice. Lastly, an analysis of true technology integration can be done.

**Teacher Support and Training**

 Consistent with widely known research around teacher quality, Bebell and Kay (2010) found that individual teachers held the most power in the success or failure of a one-to-one technology program. Bebell and O’Dwyer (2010) looked at the various levels of impact in one-to-one programs and found that common differences were linked to professional development opportunities and other program supports. Going further, Shapley et al (2010) discovered a statistically significant correlation between the quality of professional development that teachers received and their level of implementation in a one-to-one program. Taken together, the research suggests that one-to-one initiatives will be more successful in situations where school leaders provide high-quality training and support. Additionally, Shapley et al (2010) suggests that follow up support is critical as teachers will constantly learn and acquire new skills.

**Fundamental Teaching Changes**

Professional development and support for teachers seems to have led to changes in teaching practice. Bebell and Kay (2010) documented changes in teaching strategies, curriculum delivery, and classroom management. They found that over 80% of teachers in the BWLI reported that content delivery had changed, and that they most teachers felt positively about those changes. Comparably, Gulek and Demirtas (2005) credit changes in student outcomes to differences in curriculum delivery and to an increase in options for students to demonstrate mastery. Shapley et al (2010) noticed teachers who made greater progress built up their technology skills and content integration through sustained professional development. Conversely, teachers that showed little progress rejected instructional changes.

**True Technology Integration**

“When technology enables, empowers, and accelerates a profession’s core transactions, the distinctions between computers and professional practice evaporate. For instance, when a surgeon uses an arthroscope to trim cartilage…he does not think about technology, he thinks about his professional transaction,” (Weston and Bain, 2010). True educational technology integration does not focus on the technology itself. Rather, it focuses on educational practice, with technology serving to expand options and opportunity. Schools that have truly integrated technology do not think of student devices as technology tools. Instead, they consider them cognitive tools that are holistically integrated into teaching and learning (Weston and Bain, 2010). Looked at another way, Shapley et al (2010), while noticing that one-to-one programs positively affected achievement outcomes after just one year of implementation, saw those outcomes dip in implementation years two and three. However, after five years, schools that had continued implementing the program saw gains over twice as large as the gains seen in the first year. This research suggests that it takes some time to truly integrate technology into the teaching and learning practice. It also suggests that true technology integration yields significant and positive results.

**Superintendent Focus**

 A critical function of any school is assuring quality instruction (Cambron-McCabe et al, 2013). One-to-one initiatives do nothing to change that fact. Superintendents must provide high quality professional development opportunities and continued support for teachers. One-to-one programs may require initial professional development opportunities focused on learning new tools, but ultimately technology initiatives should be about expanding opportunities for teachers and students while making true instructional change more efficient and effective.

**Reactions**

 As a teacher and now a technology integration consultant, I have seen and experienced both exemplary technology integration and poor technology integration. The research highlighted above backs up my own observations. School leaders, and preferably superintendents, should take great care in being intentional about one-to-one program planning and should implement such programs with fidelity. One aspect not mentioned in this research is the great cost, both financial and in time and resources, that one-to-one initiatives require. If implemented poorly, school leaders can squander many dollars and ruin key relationships, both with the teaching staff and with the community, who often is an integral part in securing funding for the initiative in the first place.

 I was surprised to read about the strong correlation between achievement outcomes and access and use of devices at home by students. I wonder if there may be another correlating variable that may be causing such a relationship. Regardless, such a strong correlation deserves further investigation as a way to increase student achievement outcomes.

**Connections to Personal Leadership Plan**

My own experience, in conjunction with research, details how true technology integration in a one-to-one environment improves student achievement outcomes. Standardize test scores as well as skills for success in work and life both improve for students involved in one-to-one programs. The discussion, then, becomes how a school district leader can effectively implement a one-to-one initiative. The starting point must be bringing together constituents for the purpose of developing a vision for teaching and learning that prepares students for life beyond the K-12 school system. A superintendent then must communicate the vision to important groups and set up support systems in order to create an environment for change. Shapley et al (2010) concludes that effective leaders articulate a vision for one-to-one programs, develop policies that support change, foster collaboration amongst staff, and gather resources. This type of planning and setup is essential, the lack of which can be a major barrier to effective implementation (Shapley et al, 2010). So, communication and planning are crucial to any effective leadership plan.

Another takeaway is that leaders who implement with fidelity achieve better results. Indeed, participants at successful one-to-one schools report that their leaders displayed a commitment to transforming teaching and learning (Shapley et al, 2010). More specifically, committed leadership has been associated with stronger implementation (Shapley et al, 2010). Even taken out of the context of one-to-one programs, superintendents who communicate well, plan accordingly, set up support systems, and implement with fidelity surely will experience greater student achievement outcomes than those who do not.

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