ONE-TO-ONE TECHNOLOGY IN SCHOOLS: RESEARCHING THE FUTURE

by

Elizabeth R. Ferguson

An Abstract
of a research paper submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Library Science and Information Services
in the Department of Educational Leadership and Human Development
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ABSTRACT

by

Elizabeth R. Ferguson

One-to-one technology programs that provide each student with a laptop computer or other Internet-capable device can be transformative to the climate and culture of a school. Inconsistent implementation processes contribute to varying outcomes among one-to-one programs. This literature review examines research conducted on one-to-one technology programs and analyzes traits of districts where one-to-one computing has positively impacted student performance and districts with no measurable student performance gains. Successful one-to-one technology programs are carefully designed by groups of stakeholders who begin by determining what gains students will achieve as a consequence of the program. This program design includes planning of extensive, ongoing professional development; student-focused pedagogical changes that alter the traditional classroom structure; budgeting, including maintenance and replacement costs, increased technology support staff, and fees for digital learning tools; and expanded infrastructure to support increased Internet traffic. Failure to sufficiently plan for any of these components impedes benefits of one-to-one computing.
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CHAPTER 1
INTRODUCTION

Statement of the Problem

School districts providing a laptop computer, tablet, or other Internet-capable device for each student, referred to as one-to-one technology programs, are increasingly prevalent. These programs cost millions of dollars and have the potential to alter the fundamental structure of classrooms, school days, and learning processes in each district. While many educational-technology journals have published articles with suggestions for districts implementing one-to-one technology programs, there is no standard implementation plan that has proven to correlate with increased student performance. Because each district has individual needs and existing procedures, implementation processes differ dramatically between programs.

The range of implementation plans is reflected in measurements of student achievement gains in one-to-one districts. Despite some districts developing complex, student-focused strategic plans for technology integration, research shows an overall lack of measurable performance gains (Lowther 3). While positive impacts of one-to-one computing are identified in curricular areas in some schools, other schools show negative impacts in the same curricular areas. Research is inconclusive; even buildings using the same instructional programs have variant results (Spires 68).

One-to-one technology programs cost school districts large amounts of money. For example, in 2015 a moderately populated school with 200 students in each grade spending $500 on each device will require $1,300,000 for computers alone. Additional money will be required for maintenance and replacement, infrastructure expansion, additional support staff, and software
or digital subscriptions. Justifying this expense to district stakeholders necessitates substantial evidence that the program will have a positive impact on student learning. Thus, a thorough investigation of successful one-to-one technology programs must take place. The potential for improvements in school climate and culture make this necessity even more existent. School districts should identify student learning goals and objectively consider if one-to-one technology is an efficient tool to meet those goals prior to implementing a one-to-one program.

**Purpose of Study**

This study examines existing research of one-to-one technology programs and identifies features of successful and unsuccessful implementations. It determines what components are necessary for the implementation of a one-to-one technology program that will beneficially impact student learning and contribute to positive changes in the culture and climate of a school. Literature is examined regarding districts that have reported high levels of student achievement after transitioning to one-to-one computing. By examining existing literature, one may deduce what steps take place at the beginning stages of a successful program implementation and what will continue as the program progresses.

Additionally, the study determines what features exist in schools with one-to-one programs that do not result in these positive changes. Research of districts with unsuccessful programs is analyzed. The literature reveals inadequate planning is a primary deterrent to program success.

The lack of implementation standards or norms has led to most one-to-one programs having little or no measurable impact on student success. The purpose of this study is to identify features that are part of those implementation recommendations, and to demonstrate why most
programs do not result in achievement gains. By examining the failures and successes of districts that have already implemented one-to-one initiatives, district planners make more informed decisions about computing in their own districts.

**Research Questions**

The questions guiding this study are straightforward, though finding answers to each of them requires a thorough analysis of multiple pieces of research. Rather than determining if one-to-one technology programs succeed in raising student academic performance, this study presupposes that variant programs have their own successes and failures and that student gains are dependent on program planning and structure, not the presence of technology itself. Because one-to-one computing appears different at various districts, identifying common elements is a critical component of evaluating implementations. Numerous prior studies have examined the effects of specific one-to-one programming; this study seeks to find commonalities among these existing studies in order to establish a more universal understanding of what contributes to the successes and failures of one-to-one computing. The following research questions guided this study:

1. What are common traits of one-to-one technology programs that have positively impacted student performance?
2. What are common traits of one-to-one technology programs that have not positively impacted student performance?
3. What barriers exist that prevent evaluation of one-to-one technology programming success?
Limitations of the Study

The primary limitation of this study is the lack of new research pertaining to the specific topic. This study is based on existing literature and previous research; while many studies have examined the impact of specific one-to-one technology programming, this study seeks to identify a broad set of implementation features among variant programs. These features are manifested in different ways across programs. Thus, determining causality for success or failure is problematic: specific features, such as professional development or software applications, differ in topic, duration, or expense. Instead of identifying a causal relationship between programming and student performance improvement, the study attempts to identify a set of features present in previous studies. No new research is completed to test the theories stated in the study.

An additional limitation to the study is the timeframe in which the study took place. Reviewing the literature took place over the course of a few months. Consequently, this study has less accurate and specific results than a more exhaustive study of one-to-one technology program components. Conducting research specific to this study would establish a narrower list of programming features in one-to-one initiatives with differing results, but would require more time and funding. This research would require at least one year to yield an accurate examination of the one-to-one technology implementation process, and would increase in accuracy with added years of data collection. The current study was completed swiftly and is dependent on data collected for other studies.

The broad scope of this study is also a limitation. Existing literature regarding one-to-one computing examines elementary and secondary schools in the United States and elsewhere. Completing this study necessarily requires the examination of vastly different districts to pick
out similarities in their procedures. That requirement also contributes to the abundance of variant factors affecting the results. As a result, controls are limited. There is no standard for comparison because student performance differs between the studied groups prior to and after the research studies. This performance is affected by many factors, including socioeconomic features of the school population. Thus, it remains difficult to directly attribute any gains or losses in student performance to any single feature or group of features present. In part, this limitation is addressed with the third question guiding the study: what barriers exist that prevent evaluation of one-to-one technology programming success?

**Definition of Terms**

Implementation: The process by which a school district or building plans for and initiates a one-to-one program.

Infrastructure: Necessary components for technology usage, including wiring, wireless Internet systems, networking, and bandwidth or Internet speed and access.

One-to-one technology/computing: The presence of one laptop computer, tablet, or other Internet-capable technological device for each individual student in a school building or district.

Pedagogy: The methodology of teaching using established strategies to facilitate student learning.

Personalized learning: A pedagogical strategy that emphasizes the individual interests of students and seeks to relate curriculum to relevant life experiences.

Professional development: Training provided for classroom teachers and other staff to improve their performance as educators.
Student performance: Average scores on state or national tests designed to evaluate learning across a school district and compare to other districts.

Successful one-to-one programs: School districts or buildings that have experienced an increase in student performance subsequent to establishing one-to-one technology.

Unsuccessful/failed one-to-one programs: School districts or buildings that have not experienced an increase in student performance subsequent to establishing one-to-one technology.

**Research Design**

This study collected literature documenting research of school districts with one-to-one technology programs. These studies examined the effects of one-to-one computing in K-12 schools within the last decade. No original research was conducted for the study; it instead relied on preexisting research documented in peer-reviewed journals. These journals were accessed through the James C. Kirkpatrick Library website from the University of Central Missouri.

The bulk of the literature examined in this study came from EBSCO Information Services’ *Education Research Complete* database. A variety of search terms was used. “One-to-one” provided results with a broad range of subjects, so “technology” and “education” were added as additional keywords, using Boolean logic. Multiple searches were conducted, with “success*,” “failure OR unsuccessful,” and “impact” added. Computing in schools has been studied for decades. To ensure the relevance of search results, publication dates were limited to 2005 to present. Most of the articles initially examined had full-text available online, but two articles were requested through interlibrary loan because of their abstracts. Additional literature was found through *ERIC – Education Resources Information Center*, which was searched using
the same strategies as the previous database. Both databases contained numerous articles on one-to-one computing in schools that were useful for this study.

After identifying and saving articles in each database, all of the literature was printed. Each document was read multiple times and annotated. After the creation of an annotated bibliography, the articles were sorted by subject or theme to facilitate their use in the study. At the conclusion of this organization, the shape of the study was formed; it became evident that many of the articles emphasized either positive and negative effects of one-to-one computing, while others documented the various factors preventing the identification of a true correlation between one-to-one programs and student learning gains. Once the initial draft was completed, additional research was completed using Grolier Online encyclopedia, personal correspondences, and corporate websites. This additional information contributed relevant details to the study.

Conclusion

This study contains three chapters examining the effects of one-to-one technology in schools. One-to-one technology programs have not made a measurable impact on student performance in K-12 school districts. The lack of implementation standards or norms has resulted in unfocused and disorganized programs that are ineffective and unsustainable. In the following chapter, this study examines the features of programs that have reported positive effects in school climate and culture, as well as some academic gains, subsequent to one-to-one program implementation. It then identifies features of programs that have not shared these positive effects. Finally, chapter two describes some barriers that prevent attributing one-to-one technology programs with student performance gains.
Chapter three of this study answers the three guiding questions presented in chapter one. It draws conclusions based on the literature presented in chapter two and provides explanations for why these programs do not result in significant improvements in student learning. Ultimately, chapter three explains the complex components of successful one-to-one technology programs, how those pieces are forgotten in most programs, and concludes with an explanation for why the continued absence of implementation standards results in unsuccessful one-to-one technology programs.
CHAPTER 2
LITERATURE REVIEW

Introduction

One-to-one technology is an increasingly popular education trend in which a school provides each student with a laptop computer, tablet computer, or other Internet-capable device. While most participating districts dedicate significant amounts of money and time to the implementation of one-to-one programs, there is no standardized procedure for establishing them. The variety of implementation plans have resulted in many of these programs being minimally successful in impacting student performance. The research presented here will demonstrate methods of implementation used in one-to-one districts with enhanced student performance. Additionally, the research will explore factors contributing to dissatisfaction with one-to-one programs and less successful implementations. Finally, the research will demonstrate the lack of measurable, conclusive evidence regarding the impact one-to-one programs have on student performance. Ultimately, the lack of implementation standards or norms has led to most one-to-one programs having little or no measurable impact on student success.

What Makes One-to-One Programs Work

Successful one-to-one programs have many similar features. Research on districts with successful programs shows specific commonalities in the implementation process. A failure to include even one of these common features may result in the failure of a one-to-one program (McLester 36; Spires 68). These primary commonalities among successful programs are student-focused goals being established before the implementation begins; expanded technology support, staff, and infrastructure; teacher-led professional development based on pedagogy; a pedagogical
focus on personalized learning; and a shift in the overall school climate and culture, including the way teachers teach.

Principle among the features of successful one-to-one programs is a foundation built on instructional goals focused on student success. The student is the most important participant in any one-to-one technology initiative (Berrett 216). Evaluating success of any technology integration initiative requires examination of students and student learning. Instruction is strategically designed to motivate students to learn by stimulating creative thinking and questioning that is relevant, meaningful, and deliberate (Chu 48).

Successful one-to-one technology initiatives begin with an analysis of student learning goals. An examination of these learning goals leads to a strategic plan that facilitates the evolution of instruction. Successful one-to-one technology initiatives capitalize on the built-in capacity for personalized learning, “an instructional approach that encompasses both differentiation and individualization, but is also flexible in content or theme to match the specific interests and prior experiences of learners” (Demski 34). This student-centered instructional plan is enriched with opportunities for differentiation, collaboration, and individualization, and is characterized by high levels of engagement (33). Schools with successful technology integration plans begin by establishing district-wide goals for instruction, focused on students and their personalized learning. Focusing on instructional goals during the implementation process ensures technology will be used in a meaningful, productive manner that contributes to student learning. Student-centered instructional goals facilitate the district’s decision-making process in all aspects of one-to-one initiative planning, including device purchases and installation of software applications. The failure to establish student-centered instructional goals before implementation
results in an ineffective one-to-one initiative that lacks teacher buy-in and a definitive direction for student learning.

Schools such as Dassel-Cokato High School in Minnesota and Glenview School District in Illinois began the one-to-one process by establishing student-centered instructional goals focused on learning and determining a path to implementation based on desired outcomes (“Realities of 1:1” 44). The Dassel-Cokato High School planning team’s focus on student learning is demonstrated by their naming its program a Digital Learning Initiative, rather than a one-to-one initiative (44). Dassel-Cokato staff began their initiative by establishing learning objectives and invited teachers and students to help select the device with those objectives in mind (44). Glenview School District planners began by establishing goals for delivering authentic learning opportunities that went beyond the traditional classroom, and planned their initiative based on those goals (45). This emphasis on student-centered instructional goals is contrary to the focus many districts’ leaders place on the technology itself, substituting meaningful, productive technology use for technology for technology’s sake (Johnson 86; “Realities of 1:1” 45). The initial goal-setting and subsequent planning are the first of the several components of a successful one-to-one program.

The investment does not end with the technology purchase. Successful one-to-one programs also include leaders making improvements in technology staff and infrastructure in order to support the increased needs for technology support and prevent teacher frustration (Johnson 87; Wagner 32). It is critical that district leaders invest in a quality support system with frequent, open communication between technology staff and teachers (Ramig 8). In El Paso, Texas, the Ysleta Independent School District technology department is staffed with teachers
who have a unique understanding of classroom technology needs (Mortenson 18). In successful programs, the technology staff understands the importance of investing in resources such as classroom management software that monitors student activity as well as educational programs or applications (Ramig 8; “Realities of 1:1” 43). An absence of or deficiency in infrastructure is detrimental to the success of one-to-one technology programs.

In addition to the technical components, successful one-to-one program planners establish teacher led, pedagogy-centered professional development. Effective professional development is as necessary a component of successful one-to-one programs, as the device itself will change nothing without a shift in teaching strategies (Ramig 7). This professional development is continuous and ongoing, not concentrated during the implementation process (Wagner 32). Additionally, successful professional development emphasizes integration of technology into instruction, focusing on the curriculum and classroom strategies rather than using a specific program, application, or device (Johnson 86). The failure to include professional development that is relevant and worthwhile results in the loss of measurable student success (McLester 38). In order to ensure the relevancy of professional development, successful districts use train-the-trainer models for teacher-led workshops (Oliver 227). These teacher leaders know how to apply technology resources to the curriculum from experience.

Focusing on the student-centered instructional goals identified at the beginning of the implementation process enables educators to adapt the environment of the classroom. One-to-one programs are most successful when teachers share a conceptual framework; this framework includes an understanding of technology’s ability to enable individualized and personalized learning activities (Berrett 216; “Mapping a Personalized Journey” 1). Traditional, teacher-
centric classroom structures are less effective than student-centered, personalized classrooms, even when augmented with technology tools and instructional strategies like project-based learning (Chuong 2; Demski 36). Restructuring classrooms so that student interests and individualization are central to learning results in higher engagement and can even result in more independent reading happening in student free time (Demski 35). This heightened engagement and productivity fuels more student learning, and is demonstrative of success in one-to-one districts shifting pedagogy to personalized learning methods.

An example of a successful instruction unit in a one-to-one district is the implementation of literacy-based instructional programs such as Writer’s Workshop (Zheng 274). To learn writing, students are encouraged to construct their own stories that are relevant to their own lives; this personalization extends to selecting reading materials that interest individual students (Feinberg). This pedagogical shift from “drill and kill” literacy activities to constructing meaningful, personal stories can alter the atmosphere of the classroom (Feinberg).

The combination of extensive, focused professional development and a well-funded infrastructure culminates in a shift in pedagogy and, consequently, school culture (Prettyman 13). Student successes in one-to-one districts cannot be achieved without an effort by every teacher to establish a pedagogy that will affect student achievement (Spires 68). One research study showed that successful classrooms used technology to facilitate differentiation in “rigor, teacher feedback, collaboration, and instructional scaffolding” (Rosen 237). This differentiation is a hallmark of the personalized, student-centered instruction successful districts employ in one-to-one implementation (Demski 33). To establish this classroom climate, teachers become receptive to and comfortable with technology and how to use it to teach in new ways (Li 285). A
shift in teaching takes place and one-to-one programs result in measurable student gains if teachers receive related professional development throughout the school year; visible technology support is in place; and the district is working to meet student-driven, common goals. However, the failure to include even one of these features results in a loss of student gains from the one-to-one program.

**Why One-to-One Programs Fail**

Many research studies show a lack of measurable gains in student achievement driven by one-to-one programs. Because one-to-one programs are popular, many districts rush into implementation and fail to adequately plan for the many components these initiatives require. Frequently, the preparation teachers require is not provided. Professional development is centered on specific devices or programs with little regard to pedagogical shifts. Also a lack of standardized classroom device management results in increased student distraction and decreased cooperative learning. Finally, many districts do not establish a plan for funding device upkeep or replacement.

Successful implementation of one-to-one technology programs requires a complex and extensive plan for educational goals, professional development, budgeting, and staffing and infrastructure upgrades. Studies of these complexities and varying strategies for accounting for challenges have been documented in numerous research studies (Ramig 8; Topper 356). In the 2012 study of Dallas area one-to-one programs, Rosen determined the required pedagogical planning was extensive: “It requires setting new educational objectives, preparing new curricula, developing digital instructional material aligned with learning standards, designing a new
teaching and learning environment, training teachers, creating a school climate that is conducive to educational technology, and so on” (226).

In a 2012 study of one-to-one environments and learning ecology, Spires, Oliver, and Corn determined that student achievement is inconsistent between district program studies; and content area benefits vary from school to school (68). In one district, students may benefit in writing, but another district’s writing scores were not affected. Instead math scores rise. Spires, et al. attribute these inconsistencies to a failure to include a component of the complex integration process. Additionally, they point out that student achievement, when it does occur, may be impacted more by pedagogical shifts than the presence of technology (68).

The necessity of including all components of a successful implementation appear in numerous studies. A 2012 study of laptops as assistive technology for special education children determined that a lack of planning rendered the device inconsequential (Mangiatordi 62). Other studies have found top-down planning to be ineffective as well (Li 290). Unfortunately, this top-down organization, often based on selected technology rather than student-centered instructional goals developed by educators to guide teaching and learning, is pervasive (“Realities of 1:1” 45).

In part ineffectiveness of one-to-one technology is due to a lack of teacher enthusiasm; as student achievement gains are more frequently attained through pedagogical shifts than technology’s presence; unenthusiastic teachers are less likely to be successful with technology integration (Mortenson 17; Ramig 8; Wagner 31). This lack of enthusiasm extends as far as, in some cases, resembling Kübler-Ross’ five stages of grief (Wagner 30). In On Death and Dying, Kübler-Ross identified denial, anger, bargaining, depression, and acceptance as the emotional process an individual undergoes when a loved one dies (“Kübler-Ross, Elisabeth”). Teachers
demonstrate denial by asserting technology integration is a temporary trend that does not merit altering instructional techniques (Wagner 30).

Some teachers are unfamiliar with innovative instructional techniques that will enhance student learning of the subjects they are passionate about teaching (30). These teachers feel overwhelmed at the prospect of transforming their methods, especially for a perceived temporary change. This denial turns to anger as teachers feel administrator-mandated changes undermine their classroom authority and question their understanding of how students learn. Teachers feel they know their students better than administrators; they want to know their expertise is acknowledged and appreciated by administrators, and that they will be given the ability to make decisions based on that expertise (31). Once the anger subsides, teachers face the herculean task of reorganizing their classroom structures. This task can seem colossal, which leads to the bargaining stage. At this point, teachers feel the additional workload should justify reimbursement or the elimination of another responsibility (31). Technology integration also shifts some classroom control into student hands, which requires a complete paradigm shift for both teachers and students, who are now expected to seek information through technology, rather than teacher knowledge and direct instruction (31). As this classroom dynamic changes, teachers face feelings of depression. Some teachers feel they know less about technology than students, leading to feelings of inadequacy (32). At this point many teachers feel that failure is inevitable, and they will only feel different after they have experienced success. Potential success leads to the acceptance stage, but only if teachers are given support to overcome the hopelessness felt in previous stages. A natural consequence of these feelings of teacher powerlessness is resistance
and dissatisfaction, as well as a lack of the type of building or district level, student-focused goals that will ultimately lead to gains in achievement.

Lapses in adequate planning are frequently accompanied by ineffective, inadequate professional development. Many districts implement professional development plans that focus on devices, rather than the instructional strategies that will inform improved teaching and learning. As Doug Johnson points out, many one-to-one programs instruct educators to use the selected device, or focus on specific programs and applications (86). Johnson points out that this is contrary to what will make an impact on student performance: emphasizing best practices for integration of technology in a meaningful way based on student-centered, personalized instructional techniques. Rosen’s study confirms this by stressing that program implementers fail to consider pedagogy and personalized learning; this failure may be due to educators being unaware of many innovative, personalized learning strategies (Chuong 3; Rosen 226). Rosen points out numerous other studies of districts that focus on technology training rather than instructional methodology, implying that these programs fail to change the way teachers go about teaching (228). A 2012 study by Mark Storz and Amy Hoffman found that these technology-centered professional development programs themselves were inadequate, due to a disconnect between teacher competencies and expectations; development provided was “one size fits all” and not differentiated for teachers with different competency levels (Storz 18).

Storz and Hoffman also found that professional development based on technology, in addition to lacking differentiation, sometimes covered tools that were later discarded by the district; these tools fell victim to incomplete planning, deficient budgeting, or miscommunication between district departments (18). Another flaw in this type of professional development is
highlighted when the specific programs are not utilized in certain subject areas, such as science. In these cases, the technology itself becomes underused (Spires et al. 67). The variance in teacher use stems from the concentration of technology use to one or two software programs or Web applications, rather than its use as an integrated learning tool, with which students learn across the curriculum in a personalized manner, using technology to access information relevant to student interests (67). In other cases, the technology is used primarily as a reward during students’ free time, and not as an integral part of the learning process across all subjects, every day (McLester 36).

Another factor that may prevent the systemic use of technology as a learning tool is a limited connection between existing learning goals and new strategies that are presented. The introduction of technology requires a complete reorganization of the learning process and instruction that frequently moves away from traditionally lauded cooperative learning toward independent study (Storz 4). A lack of adequate professional development results in teachers not using innovative, high depth-of-knowledge instructional strategies, but instead assigning activities that have a high aesthetic quality but little depth (Storz 13). For example, teachers inexperienced with inquiry-based or problem-based instructional design may assign activities requiring recall of knowledge rather than synthesis, analysis, or evaluation. Students insert this recalled knowledge into PowerPoint, Prezi, or Keynote presentations in an attractive and impressive display, yet the lack of depth remains. At other times, students are able to find information faster, but there is little evidence of knowledge retention (13).

One barrier to knowledge retention may be the distraction caused by the devices. In a 2011 and 2012 study of one-to-one technology, researchers found that 73% of students felt that
social media was a moderate to extreme distraction from learning (Andersson 43). Another 2010 study of middle school students found that one-to-one technology increased student engagement with technology itself, but found most students were not engaged in the assigned learning activity (Donovan 436). This study found that highly-motivated students were able to complete independent learning tasks by the assigned deadline, but less-motivated students were not. Researchers found that teachers assigned more personalized, project-based activities to the highly-motivated students who, despite engaging in off-task activities on the computers, maintained a level of success (437). These highly-motivated students came to class and immediately began using devices; they worked independently to track work, communicate with teachers, and collaborate with each other (432). Less motivated students, identified in the study as those who were unprepared for class and required frequent direction, were assigned “daily language drills or Internet scavenger hunts,” but were too distracted by the computers to complete the tasks or, in some cases, did not bring the technology to class (437). Teachers of the less-motivated students were more likely to stop using the laptops entirely as a result of this disengagement, eliminating any potential benefits the device may have offered (437). On the surface, it appears that students are on task when they are quietly engaged with the computer, but in reality many students are browsing social media websites or engaged in other recreational computer-based activities. The appearance of learning can be detrimental to actual learning, as educators use technology time as a replacement for classroom activities such as discussions, cooperative learning, and teacher-guided instruction (Larkin 112).

The transition of classroom activity from traditional methods to technology is also expensive. The educational software that could facilitate meaningful learning activities, such as
research databases from Gale CENGAGE or full versions of Canvas or other virtual classroom applications, can cost substantial amounts of money. Gale offers a line of In Context databases with nonfiction articles and media content in categories such as Global Issues, Science, and US History; each database costs nearly $2,000 for a public school with an enrollment of approximately 1,000 students (“Gale in Context”; Harrell). Canvas is a learning management system that enables students to access content online, including embedded videos from external websites such as Khan Academy and YouTube (“What Is Canvas LMS?”). While a free version is offered, an official school Canvas learning management system requires an initial fee as well as an annual fee based on enrollment (“LMS Pricing”). Unfortunately, districts frequently fail to budget for software programs and applications that, though costly, have a positive impact on student performance (Ramig 8).

Additionally, districts take on a significant staffing expense in order to support staff and devices (Johnson 87). Yet another expense is the bandwidth and infrastructure necessary to facilitate use of hundreds, or thousands, of devices (87). These ongoing expenses, in addition to the money diverted to replacing or repairing devices, add up quickly. Many one-to-one programs, such as the aforementioned engagement study by Donovan, are funded by grants. While grants help districts provide technology for all students, rather than relying on families to provide “bring your own technology” devices to school, these grants must be duplicated every few years in order to reproduce the investment as devices become obsolete or wear out (McLester 38). Thus, inadequate financial planning is another feature of one-to-one technology initiatives that do not make a significant impact on student performance.
Inconclusive Research Regarding One-to-One Computing

Despite the high hopes of districts implementing one-to-one programs, there is no conclusive evidence that these programs improve student achievement. Test scores generally do not rise, and there is contradictory data in districts that do see gains. Because no standard for implementation exists, each district’s plan results in varying successes and failures. Positive results are inconsistent, and those results are difficult to attribute to technology itself. For example, successful districts tend to implement other pedagogical programs simultaneously, which may be the cause of the student achievement gains.

Although standardized tests are a controversial measure for student achievement, they are currently the best method in place for evaluating student performance. In most studies of one-to-one technology efficacy, the results are the same: test scores do not rise as a result of one-to-one programs (Lowther 3). One barrier to identifying performance improvements is the difficulty in evaluating technology skills and their improvement. Traditional standardized tests do not evaluate the skills students acquire from learning with technology, such as critical thinking and research (McLester 35). While these testing limitations are evident, it remains that measurable gain across most one-to-one programs is lacking (35). Studies of one-to-one programs in Michigan showed an increase in engagement led to fewer discipline problems, but this engagement does not correlate to time spent on task and learning (Donovan 437; McLester 35).

Perhaps one explanation of stagnant test scores is the distraction caused by the technology. However, data collected about this distraction is also inconsistent. A 2012 study by Andersson, et al. cited student frustration with peer social media use, specifically noting student feelings such as, “[it] often feels like you are the only one working” (Andersson et al. 44). The
implications of the research in this study were that most students found Facebook and other social media websites to be a distraction. Researchers found that 65% of the students felt they used social media “too much” (43). One-to-one devices were detrimental to the work of students who were less able to self-regulate, or at-risk students (43). A 2013 study by Zheng, et al. had contradictory results, however. This study, which examined one-to-one programs in California and Colorado, found that “at-risk” students, and especially minority and free-lunch students, benefitted the most from the technology. Coincidentally, all other student achievement differed greatly between schools, with at-risk students being the only group to consistently gain (Zheng 67). Perhaps this gain can be attributed to increased home use of technology, as home usage of technology has correlated to higher performance and awareness of assignments in other studies (Jing 114; Thompson 18). Student success is entirely due to the effort of the students, with little to no scaffolding in place from the teacher. This deficit results in more inconsistencies between programs, leading to the conclusion that student performance is affected more by outside factors than the introduction of technology in classroom instruction.

The distraction of social media also contributes to the decrease in cooperative learning seen in one-to-one classrooms. The Andersson et al. study shows that students feel their peers are unable to self-control social media use. This feeling of frustration leads to one student, assumedly the student best able to moderate use, completing all group work himself or herself, or having the perception of doing so (Andersson et al. 44). In this study, 71% of students expressed that they do far more independent work and shared that traditional cooperative or collaborative projects were now split up to be completed simultaneously, rather than being completed collaboratively as before (43). A 2008 study by researchers at North Carolina State University
corroborates this finding, and expands on it. In this study, students were found to use technology independently 100% of the time during the first year, as opposed to 83% independent work before implementing one-to-one (Oliver 225). Despite popular beliefs that one-to-one technology is a panacea for contemporary problems in education, a 2011-2012 study found that one-to-two technology was far more efficacious in stimulating collaborative activities in the classroom (Larkin 101). It should be noted that this study found one-to-two programs to be beneficial in other pedagogical areas as well, but it stands alone as a study of this type of technology program.

While research of cooperative learning in one-to-one schools consistently demonstrates a decrease in collaboration, other outcomes vary greatly between districts. The aforementioned study in California and Colorado researched implementation of very similar programs, but student gains were varied and inconsistent (Zheng 284). This inconsistency is also demonstrated by a 2012 Michigan study that demonstrated gains, losses, and no measurable difference between sets of schools being researched (Lowther 23). The primary benefit of one-to-one programs in multiple studies appears to be the enjoyment students have for using the devices (Storz 11; Zheng 285). However, even this perception of enjoyment is inconsistent, as some students are disappointed by feelings they are not being taught as much by teachers (Storz 11). Additionally, many teachers feel frustrated by constant monitoring or “policing” device use as students attempt to use social media (Andersson et al. 46). In fact, teachers used words such as “powerless” to describe these feelings of discontent (46).

Student achievement gains are inconsistent within one-to-one programs, as many other factors contribute to student success and student or teacher satisfaction. One commonality among successful one-to-one programs is the simultaneous implementation of pedagogical strategies
such as personalized, literacy-focused teaching initiatives. One district technology director noted that it was ambiguous whether gains were due to the one-to-one program or a reading apprenticeship program the district implemented (McLester 36). Another district implemented Calkins’ Writer’s Workshop with the one-to-one program, another program with potential to greatly affect student performance, even without technology tools (Zheng 274). A 2008 study pointed out that student success is affected by many different factors, pointing out that outside factors fluctuate and make determining causality impossible (Jing 114). Because there are no standards or control groups for comparison, it is not possible to attribute student performance gains to the presence of one-to-one technology.

Summary

Without standardized implementation procedures, one-to-one technology programs differ between districts. Data regarding the benefits of these programs is inconclusive and does not show measurable gains in student learning. Some school districts establish learning-focused goals and systematically plan one-to-one initiatives to achieve them. These districts report improvements in some student performance areas and school climate and culture. Other schools fail to adequately plan for one-to-one computing and do not experience the same benefits. The following chapter draws conclusions from existing data on one-to-one computing. It analyzes the successes and failures of these programs, and explains what barriers prevent the demonstration of student performance gains.
CHAPTER 3
CONCLUSIONS

Introduction

One-to-one technology initiatives provide opportunities for students and teachers to alter the traditional classroom environment in positive, meaningful ways. However, the lack of normalized implementation procedures contributes to one-to-one technology initiatives having no significant impact on student performance. To determine why student performance does not measurably improve with most one-to-one initiatives, researchers examined three key questions: what are the features of successful one-to-one programs; what are the features of one-to-one programs that do not positively impact student performance; and what barriers obstruct demonstration of student achievement gains?

Ubiquitous technology enables educators to implement personalized, student-centered instructional techniques that focus on student interests and promote literacy. Appropriate professional development and advances in infrastructure and personnel can facilitate advantageous changes in school culture that benefit students. However, many schools implement technology initiatives without adequate preparation. Districts fail to prepare teachers to teach in technology-centric environments with instructional strategies different than those traditionally seen in K-12 schools. Instead of becoming indispensable learning tools, devices become a distraction. This lack of sufficient professional development is coupled with inadequate infrastructure, funding, and technology staffing. Research studies show a lack of conclusive evidence that one-to-one technology initiatives benefit student achievement. Furthermore, the existing data gathered on one-to-one programs is contradictory. Inconsistencies in
implementations limit the evaluation of programs, and a lack of established best practices prevents any formal measure of gains or losses caused by these programs.

**Traits of Successful One-to-One Technology Programs**

Overall, one-to-one districts do not see significant, measurable gains in student performance on standardized tests, but some districts report qualitative improvements in school climate. A few districts have reported slight gains in student grades or test scores as well. While there is no established protocol for implementing a one-to-one technology initiative in a K-12 school, programs that have positively impacted school climate and student performance share several features. At the core of a successful initiative is a set of student-centered instructional goals; stakeholders must come together to decide what benefits the device should provide for students. These goals drive all decisions made for the devices, including what device is purchased and what professional development takes place.

Professional development and device support are two critical components of any one-to-one program’s success. Professional development must be continuous, and extend beyond the initial stages of implementation. Professional development in successful districts emphasizes pedagogy; teachers learn student-centered instructional strategies that capture the attention of students and make learning relevant and individualized. While it is critical that educators utilize technology in every curricular area, with successful initiatives professional development focuses on instructional methods rather than specific software or hardware tutorials. Personalized learning is at the core of this pedagogy. This focus on students sets apart successful one-to-one districts from the majority of programs.
In addition to receiving student-centered professional development, teachers in successful one-to-one districts are given ample technological support. These districts boost support by providing staff who are trained to focus on teaching and learning. Additionally, networks capable of supporting a vast quantity of Internet-capable devices have been established. The failure to include even one component of these successful initiatives results in the program failing to impact measurable student performance gains.

**Traits of Unsuccessful One-to-One Technology Programs**

One-to-one technology programs do not significantly impact student performance in most school districts. This failure is the result of insufficient planning in the beginning stages of the implementation process. Most districts beginning a one-to-one technology initiative fail to consider the needs of teachers and students while making decisions about which device to purchase and what software applications or Web subscriptions to include. Little teacher training takes place, and that limited training focuses on specific software or hardware usage, rather than pedagogy. Consequently, the systemic shift in instructional style that must happen to fully receive the benefits of teaching with technology never takes place.

Instructional styles in unsuccessful one-to-one districts continue to focus on the teacher rather than the student. These classrooms maintain a traditional structure where the educator gives information to the students. Traditional classrooms do not, in general, require students to seek information and construct their own learning; education is not personalized, but is generalized for the entire class as a whole. Unsuccessful one-to-one programs do not adequately train teachers to adapt teaching methods, so a shift in pedagogy does not take place. When students are not engaged in the learning process, the device becomes a distraction. Instead of
using technology for inquiry, students spend time on social media websites. This lack of engagement frustrates students and teachers alike, leading to a decrease in device usage as a whole. Lack of student-centered instruction contributes to one-to-one technology programs not having a measurable impact on student achievement.

Inadequate planning of one-to-one technology programs extends beyond a lack of instructional training. Many districts receive funding through grants or bonds to make the large, initial technology purchase. However they fail to plan for spending on infrastructure and support staff. The large number of devices accessing the Internet requires districts to invest in greater bandwidth and networking. Also high-quality instructional resources such as research databases cost ample amounts of money on an annual basis. Additionally, a greater number of devices requires a greater number of technicians to fix any problems that arise. These devices themselves will break or become obsolete after a few years; many districts do not adequately plan for device repair or replacement costs. Funding that is insubstantial or not reproducible contributes to the failure of one-to-one programs.

**Barriers to Evaluating Successes of One-to-One Technology Programs**

The inconsistency between different one-to-one technology initiatives is a barrier to evaluating their successes. Districts implement programs differently, with unique goals, and consequently succeed and fail in different areas. Many districts that see student achievement gains on standardized test scores have simultaneously implemented pedagogical shifts. It is unclear whether these student gains are a result of technology tools, instructional methods, or both. However, even districts implementing innovative teaching methods with technology see contradictory results, with scores rising and falling in content areas across buildings within the
same district. Results are erratic in general: while one district gains in math, another loses, and while one district loses in reading, another gains. These contradictory data demonstrate that one-to-one programs cannot be attributed with significantly impacting student performance.

Contradictions in data extend beyond standardized test scores. Research also demonstrates inconsistencies between student groups benefiting from one-to-one technology. While one study finds at-risk students benefit the most from technology, another study finds these students are most distracted by it. One cause of this contradiction is a misperception: while students may be engaged with technology, they may not be engaged with the learning task assigned. A classroom may be quiet and full of students actively utilizing technology, but those students may not be learning class content. Another misperception is that students with one-to-one technology can collaborate more efficiently. Instead, research finds that cooperative learning decreases with one-to-one technology as students divide tasks to complete independently instead of truly engaging in collaboration. These inconsistencies and misperceptions contribute to one-to-one technology initiatives not being credible sources of gains in student performance.

Until there are standardized one-to-one technology implementation norms, there is no definitive way to evaluate program success. Because quantity and focus of professional development differs between districts, there have been no specifically determined best practices. Because instructional goals differ between student groups, no specified result has become a targeted goal. This lack of best practices and student goals is reflected in standardized testing, which has not yet adapted to evaluate technology-centric learning. The inquiry focus of many programs is still not measured by most tests, nor is technology aptitude. This lack of
standardization is at the core of one-to-one programs failing to significantly impact student achievement.
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