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Staying Connected: Measuring the Impact of Technology Integration on Student Engagement and Achievement at the Middle Level

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Staying Connected: Measuring the Impact of 1:1 Technology Integration on Student Engagement and Achievement at the Middle Level

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Abstract

Knowing how technologies impact student engagement and achievement is vital. The present study validated and added to the existing knowledge in determining to what extent specific levels of technology integration impact student engagement. It also addressed how specific levels of technology integration impact student achievement in middle level English Language/Arts and mathematics classrooms using 1:1 tablet technology. The descriptive study with statistical analysis provided quantitative evidence to educational leaders on the extent to which increasing levels of technology integration can increase student engagement. This evidence was generated using classroom observation data and Fisher's exact cross-tabulation analysis. The study also provided conclusions on technology integration levels impact on achievement in middle schools struggling to meet proficiency as measured by state-mandated summative assessment, by comparing technology integration levels from classroom observations, to summative assessment results. Although no statistical significance between technology integration levels and levels of student engagement observed, there were observable positive effects of higher levels of technology integration increasing student engagement. Further, no observable relationship was found between technology integration levels and summative assessment scores.

Keywords: technology integration, engagement, achievement, digital leadership

Dedication

This work is dedicated to the following:

To God, who has provided me with the unwavering strength, perseverance, and the daily gifts of grace and mercy to fulfill this dream; to Him, I give all the glory.

To my husband, Lawrence Scott Swayne, for his never-ending love and support in pursuit of this work, this degree, and my passion for education. I love you more than words can say, more and more each day.

To my children, Isabella, Isaiah, and Jeremiah Swayne: for your patience, your inspiration, and being the greatest source of love in my life. Let this work be a reminder for you to never let your circumstances define you, but rather push you to pursue your passions in life, and achieve your dreams with the greatness and strength God has instilled in you.

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Chapter 1: Introduction

As the world becomes increasingly smaller via newfound and ever-changing digital connections, the need for education to integrate these technologies is ever-increasing. Teachers and students utilizing touchscreen tablet technology in 1:1 the classroom setting is an example of an instructional strategy aimed at increasing student engagement and achievement. Although digital distractions are a reality in the challenge to integrate technology at meaningful levels, the importance of students using 21st century technology to prepare them for their future is great. This reaffirms the necessity for the practice of educational leadership to encompass digital leadership, as a core element in transforming organizations to meet success within the technological societies of this shrinking world. Five years ago, nearly 90% of the world's population had a mobile device and, as of 2013, the Apple App store supported over 700,000 apps for the iPad (Sheninger, 2014, p. 4). Using touch-screen technology, 21st century citizens can unlock gateways to an infinite amount of knowledge, social, and digital communications with a simple swipe of the finger. This technology is a part of the everyday lives of students, yet it is often absent from their learning processes in the classroom, resulting in student disengagement (Sheninger, 2014). Individual as well as social learning experiences have evolved to incorporate a constructivist and more dialogical teaching style using digital devices (Carr, 2012).

As Wegerif (2007) noted, the space of learning has changed and the challenge is not solely technological, but is also conceptual. Specifically, "Developing a new pedagogy for the Internet age is not only about developing new practices, it is also about developing a new way to understand our new situation" (Wegerif, 2007, p. 11). This “new situation” is a challenge for many educators attempting to create a new path, chart uncharted waters, and successfully swim into the current of effective technology integration for increased student engagement and achievement (Sheninger, 2014). Although similar journeys have been taken regarding 1:1 technology integration with computers and laptops, iPads are still relatively new to many teachers, students, and parents, especially across America’s most rural school districts (Lewis, 2010). There is a gap in how teachers teach with technology and how students learn with technology (Technopedia, 2016). In rural school settings, technology barriers such as the availability of technology and access to usage increase the gap (Lewis, 2010, p. 42). To attempt to close those gaps, 1:1 settings equating to one technological device for every student within a classroom are becoming more prevalent in schools across the United States (Sheninger, 2014). Efforts to increase student engagement for academic achievement gains by providing the latest technologies to all students has proven successful (Maninger, 2006). The success of past 1:1 initiatives using laptop computers has evolved to 1:1 initiatives using iPads.

One example of a 1:1 initiative is in West Virginia (WV), where one of the state’s largest school districts provided iPads for every (S-ABC, 2016). Specifically, all middle schools in this WV school district are now 1:1, with all students having access to their own personal iPads 24 hours a day, 7 days a week. This was a direct result of the S-ABC school district’s Learning 20/20 iPad initiative (S-ABC, 2016). The purpose of the initiative claimed to support several schools in the district that had fallen short of expected levels of achievement as measured by the state summative assessment, the Smarter Balanced Assessment (SBA) (S-ABC, 2016). The opportunities for students below the poverty line to access newfound ways to enhance their educational experience became limitless. Teachers also received iPads along with professional development on how to integrate the new and innovative technology tools into their classrooms from Apple, Inc. technology integration specialists (S-ABC, 2016). This professional development was a foundational pillar of the Learning 20/20 iPad initiative, and was designed to enhance curriculum delivery, student engagement, and thus increase student learning and achievement (S-ABC, 2016). Although iPads are not the expected solution to schools falling short of mastery in student achievement, the district-wide initiative was one strategy being implemented to aid all schools in increasing achievement levels toward proficiency (S-ABC, 2016).

Background, Context, and History

Teacher quality, student engagement, and technology integration have all proven to have a quantifiable impact on student achievement (Theis, 2016). Tucker and Stronge (2005) reminded the world that the power of an effective teacher is transformative. Their work referenced the research of Dr. Bill Sanders and Dr. Robert Marzano, and quantified the percentile gains possible when an effective teacher uses the most effective strategies (Tucker & Stronge, 2005). Although technology in and of itself is not a strategy, merely a tool, it can enhance curriculum delivery by elevating effective teaching strategies. For example, just prior to the revelations of Tucker and Stronge (2005) with respect to teacher effectiveness, Apple Inc. (2002) declared the positive impact of technology on student achievement. Specifically, students with regular access to technology learned basic skills faster and more effectively, attendance increased, dropout rates decreased, and SAT performance even increased (Apple Inc., 2002). A decade later, Apple introduced the world to the iPad. Consequently, this mobile device catapulted itself into school systems as the premier tablet technology for 1:1 initiatives in schools (Sheninger, 2014).

Therefore, the availability of new innovative technologies, coupled with the evolution of the digital learner, requires teachers and educational leaders to not only integrate technology but also evaluate the level at which it is integrated. Just as teachers reflecting on instructional strategies can increase student achievement, reflecting on the effectiveness of technology integration is equally necessary (Theis, 2016). This reflection leading to understanding can eliminate the lesson flop, i.e., technology becoming the problem and not the solution to an enhanced educational experience (Romrell, Kidder, & Wood, 2014). The work of Sheninger (2014) stressed the reality of today's learners being born digital. This translates to their need to be engaged and provided with autonomous learning opportunities empowering them to be creative, innovative problem solvers (Sheninger, 2014). In the words of Mark Prensky, "Our students have changed radically. Today's students are no longer the people our educational system was designed to teach" (cited in Sheninger, 2014, p. 14). Consequently, students do not know how to use the technology they are immersed in for learning; therefore, it becomes the responsibility of educators to facilitate this connection (Sheninger, 2014).

Staying connected to digital learners by elevating student engagement and achievement via technology, and determining what level of technology integration is most impactful in doing so, therefore, can illuminate a seamless path to increased student achievement (Theis, 2016). Nicholas A. Christakis (2010), a modern-day researcher, delivered a series of lectures on the power of connectivity. As cited in Robinson (2011), "The ubiquity of human connection means that each of us has a much bigger impact on others than we can see" (p. 83). This impact can be positive or negative depending on the connections transferred to one another (Christakis, 2010). One specific example illustrated the fact that both soft, dark graphite and clear, hard diamond are composed of carbon. What determines whether the substance becomes graphite or diamond is not contingent upon what exists in the carbon itself, but arises because of the interconnections between the atoms, the chemical bonds (Christakis, 2010). Effective technology integration does not happen without the right interconnection, i.e., students engaged with a level of technology integration that challenges them to be transformed into proficient 21st century digital learners.

Statement of the Problem

As technologies advance and student proficiency in technology often surpasses that of teachers, meaningful use of classroom technology is a 21st century challenge (Sheninger, 2014). An example of such a challenge was found in low-performing schools that housed grades six to eight. These middle schools were a part of the district-wide 1:1 iPad initiative, Learning 20/20, which was designed to increase technology integration to enable student performance in mathematics (math) and ELA summative assessments (S-ABC, 2016). The data supporting this problem derives from the SBA given to all students attending public schools in the state of WV (West Virginia Department of Education [WVDE], 2016). The results of this assessment produced data supporting a problem in achievement for students at these middle level educational organizations. Specifically, in both ELA and math, 50% of sixth, seventh, and eighth graders failed to achieve proficiency in the SBA during the spring of 2015 (WVDE, 2016). While technology integration is not a total cure for this deficiency in student achievement, if teachers incorporate learning technologies with innovative pedagogical practices, the 1:1 initiative could be a driver of positive educational change (Valiente, 2010).

Additionally, the *Elementary and Secondary Education Act* (ESEA) was shifting to Policy 2320: A Process for Improving Education: Performance Based Accreditation System to set specific index targets (WVDE, 2016). The index target was the number derived from the WVDE's compilation of past summative assessment data and an estimated growth score for an individual school (WVDE, 2016). If schools did not sustain growth and continually achieve the index target for their school, it resulted in a low grade (WVDE, 2016). To avoid a low rating on the school accountability scale of A–F, where 90% of that rating is derived from proficiency and growth on the SBA, using the technology provided was a new strategy (S-ABC, 2016).

Unfortunately, this new strategy focused on technology integration that did not have buy-in from all district members. Despite positive advancements and opportunities for increases in student achievement technology in the classroom, there is substantial evidence verified from S-ABC technology Bright Bytes surveys revealing concerns about technology's place in education (S-ABC, 2016). The results from the 2014 and 2015 surveys revealed that nearly 50% of the district's teachers believed they did not feel prepared to add iPads as a tool for instruction, despite being willing to learn (S-ABC, 2016). The range of reasons referenced in the survey varied from personal technology proficiency, classroom management, and knowing how to align apps to curriculum.

Similarly, DeLoatch (2015) cited four negative sides of technology including changing the way children think, the way children feel, putting their safety at risk, and less physical activity. Fortunately, monitoring technology usage and staying current with technology training enables teachers to use technology to augment, not substitute, teaching, and thus avoid integration having a negative impact (DeLoatch, 2015).

Purpose of the Study

The demand for teachers to find a balance in technology integration targeting a level of effectiveness has become a part of the requirement for a safe and appropriate learning environment for all students. This safe learning environment is defined as being free from non-educational distractions and minimizes threats to the emotional safety of children found in avenues such as cyber-bullying (DeLoatch, 2015). Therefore, finding an appropriate measure offering meaningful feedback to educators leading a 1:1 initiative in the hope of increasing student achievement was vital to the success of the S-ABC district initiative, as was the goal of increasing student performance on the SBA (S-ABC, 2016).

The purpose of the present study was to compare technology integration to both student engagement and achievement. Its more refined purpose was to offer guidance for teachers, educational leaders, and technology integration specialists on the levels of technology integration that have the most positive impacts with respect to student learning. Cross-tabulation analysis was utilized to compare technology integration levels to student engagement and student achievement.

Research Questions

To target the purpose of the study, the following questions were designed to analyze the root causes of ensuring successful outcomes in technology integration.

Q1. To what extent, if any, is there a statistically significant relationship present between middle school students' levels of engagement and levels of technology integration during content area instruction of ELA and math classes, as measured by a Substitution, Augmentation, Modification, and Redefinition (SAMR) model instructional practice inventory?

Q2. What is the relationship between middle school students' summative assessment performance, in the areas of ELA and math, and levels of technology integration during content instruction of ELA and math?

These questions addressed what levels of technology integration are found during English Language/Arts (ELA) and math classroom instruction in middle school organizations. The overall frequency of these levels were then compared to student engagement levels within these same classrooms using Fisher's Exact cross-tabulation to test the data collected for statistical significance. Finally, the average levels of technology integration and levels of student engagement were compared to student achievement levels of those students receiving instruction during the classroom observations. To answer these questions, teacher observation data evaluating teachers' levels of technology integration incorporated the SAMR model (Puentedura, 2014). This combination sought to eliminate, "Ongoing substitutive uses of the technology that block, rather than enable, more ambitious transformative goals" (Puentedura, 2014, para. 1). It further afforded teachers the opportunity to connect the familiarity of Bloom's taxonomy to a modern barometer for technology integration (Puentedura, 2014).

Relevance and Significance of the Study

As Lewis (2010) determined, a quantitative approach better determines the rate of technology usage as well as what level of technology is being utilized. However, the rate of usage and type of technology does not measure the quantitative gains made possible by analyzing the frequency of levels of technology integration increasing both student engagement and achievement (Puentedura, 2014). Thus, the present study utilizing quantitative measures offered the educator new information on the extent to which implementing technology at a higher level can impact student engagement and student achievement. Further, it presented educational leaders with evidence for facilitating professional development and training to enable teachers to increase their levels of technology integration (Puentedura, 2014). This can be supported by the existing literature on the impact of the teacher on student achievement, the importance of technology integration and its impact on student achievement, and the importance of student engagement as it relates to the way in which digital natives learn most effectively (Sheninger, 2014). Therefore, the problem of increasing ELA and math proficiency at the middle school level using meaningful technology integration was relevant to all 21st century educators striving to achieve a balance in technology integration for increased student engagement and achievement.

Definition of Terms

The following conceptual terms will be utilized to guide and define the work presented throughout the research study:

1:1: The term utilized to describe an educational setting where every student and teacher has a technology device (Apple Inc., 2002).

Apple: The technology company supplying both iPads and professional development specialists within the school district (S-ABC, 2016).

Apps: Specific applications downloaded by teachers and students to use on tablets (Carr, 2012).

Bloom's taxonomy: An educational hierarchy utilized to define learning domains and objectives (Puentedura, 2014).

Bright Bytes: A yearly survey given to district professionals, which rates technology usage and proficiency (S-ABC, 2016).

Connection: The ability of teachers to foster meaningful relevance to the content of their instruction as well as their ability to facilitate meaningful teacher-student relationships (Sheninger, 2014).

Digital divide: The gaps among populations in technology usage and proficiency (Technopedia, 2016).

Digital leadership: The role of school administration in supporting both teachers and students in the Learning 20/20 iPad initiative (Anderson, 2014).

Digital learner: Students who learn using various technologies including, but not limited to, the iPad (Sheninger, 2014).

Digital native: Students born into a technology dependent environment where they have not previously lived without technology (Sheninger, 2014).

Educational technology: Tools and programs specifically designed for educational purposes (Apple Inc., 2002).

Elementary and Secondary Education Act (ESEA): State legislation governing how schools in the state of WV are rated on yearly performance (WVDE, 2016).

Impact: The effects of the implementation of instructional practices (Puentedura, 2014).

Index target: The projected target determined by the WVDE as the score a school should achieve on the yearly performance assessment (ZoomWV, 2016).

iPad: A portable technological device, i.e., computer tablet, activated by a touch screen provided to all middle and high school students as part of the S-ABC Learning 20/20 iPad initiative (Carr, 2012).

Instructional Practice Inventory (IPI): A barometer measuring levels of student engagement (Valentine, 2009).

Learning 20/20 iPad Initiative: A technology integration initiative designed to make all S-ABC middle and high schools 1:1 by the year 2015 and all elementary schools by the year 2020. The goal of the initiative is to have all S-ABC students' technology proficient to enhance curriculum, instruction, and student performance, equipping them for success in the 21st century (S-ABC, 2016).

Policy 2320: The newly adopted policy by the WVDE providing performance ratings to all WV schools based upon a rating scale of A–F (WVDE, 2016).

S-ABC: A pseudonym for the large school district and home to the middle schools at the focus of the present study (S-ABC, 2016).

Substitution, Augmentation, Modification, and Redefinition (SAMR): A model utilized to determine how computer technology may impact teaching and learning using the terms Substitution, Augmentation, Modification and Redefinition (Puentedura, 2014).

Smarter Balanced Assessment (SBA): The end of year performance assessment given to all public-school students in the state of WV. Results are utilized to assign performance ratings to all schools (WVDE, 2016).

Student achievement: The various levels at which student learning is measured such as grades and assessment scores (S-ABC, 2016).

Student engagement: The level of attentiveness, interest, and activity of students (Valentine, 2009).

Student performance: The measures or scores of students' learning on summative assessments (WVDE, 2016).

Technology integration: Technology tools, resources, and activities utilized by both teachers and students to enhance curriculum and instruction (Puentedura, 2014).

West Virginia Achievement Index (WVA): The index scores assigned to and earned by all public schools in WV as evaluated by the SBA (WVDE, 2016).

West Virginia Department of Education (WVDE): The state level of authority governing WV in all levels and areas of education (WVDE, 2016).

ZoomWV: The summative assessment database utilized by the state of WV to define the performance ratings of all schools (ZoomWV, 2016).

Assumptions, Delimitations, and Limitations

One assumption guiding the present study was the expectation that the observed ELA and math classrooms integrate technology regularly. This implementation would align with the district's adoption of the Learning 20/20 initiative (S-ABC, 2016). More importantly, this integration would align with transitioning students to a blended learning model, which is likely to increase student engagement and ultimately have a positive impact on learning (Sheninger, 2014). This assumption then leads to observations being relevant to the purpose of the study and provides quantifiable data to be analyzed.

In terms of delimitations, the three middle schools where observations occurred were intentionally selected, as they comprised a microcosm of the total population in terms of demographics and assessment results of less than 50% proficiency in both ELA and math on the 2016 SBA (ZoomWV, 2016). This selection created a delimited sample size of only 3 schools and less than 15 classroom observations in each content area of ELA and math. A secondary delimitation included only choosing schools with ELA and math proficiency rates of less than 50%. A final delimitation was that only one rater completed the observation process, which afforded consistency and avoided bias in completing the data collection process via classroom observations.

Classroom observations were conducted using a data collection form documenting the level of technology integration and the level of student engagement present during each class period observed. These observations took place in grades six, seven, and eight at three middle schools, and included both ELA and math classrooms. The data collection form was guided by a rubric that measured the level of SAMR utilized and the level of student engagement was measured by the Instructional Practice Inventory (IPI) scale (Valentine, 2009). The data from these observations were then compared to the end of year SBA assessment results of students from the middle schools where the observations took place. This created the data necessary to determine the relationship between classroom learning environments that integrate technology at a higher level as measured by the SAMR model and the achievement levels of those students.

Summary

Technology integration is an essential component in the 21st century classroom (Sheninger, 2014). This component often has a positive effect on student engagement and can increase student learning gains (Carr, 2012). As technology evolves, using it as a tool to increase student engagement during meaningful curriculum delivery is an added benefit to increasing student proficiency to be prepared for success in the digital world (Roth, 2014). Therefore, a descriptive study designed to compare and analyze the relationships among technology integration, student engagement, and student achievement is valuable to the digital leader, teacher, and digital native. The present study includes a comprehensive literature review outlining the conceptual framework and context of the study (Chapter 2), followed by a detailed methodology explaining the approaches and processes by which the study was carried out (Chapter 3). Chapter 4 illustrates the data analysis resulting from the completion of the study. The fifth and final chapter is dedicated to the conclusions drawn from the total work, along with recommendations for future research endeavors in measuring the effects of technology integration in education.

Chapter 2: Literature Review

Introduction

In 1988, a great-grandfather visits the first-grade classroom of his twin great-granddaughters to view first-hand a computer in the classroom. One large desktop shared among over 25 students amazed a man who had survived The Great Depression (personal communication, 1988). In 1991, former Deputy State Superintendent of WV Schools, James Gladwell, invited his twin granddaughters to participate in testing IBM's Writing to Read software program showcasing what was eventually implemented in all WV elementary schools (Kinnaman, 1991). In 1999, college entrance essays were completed in computer laboratories located at the local library, and schoolteachers signed up for school-based laboratories so students could complete research on the Internet. In 2004, a first-year teacher was given a personal laptop computer to use and a mobile laboratory of laptops for students to use. In 2006, an interactive whiteboard was given to a novice high school teacher to further infuse instruction with technology. In 2014, a curriculum assistant principal was given an iPad and a MacBook, and became part of a team preparing students and teachers for a 1:1 technology initiative, enabling over 10,000 students to have iPads 24 hours a day, 7 days a week (S-ABC, 2016).

Technology integration for education has evolved at a rapid pace and the only constant element regarding its presence in the classroom is change at warp speed (Sheninger, 2014). Moreover, technology integration for increasing both student engagement and achievement has evolved from the desktop to the laptop, from the portable laptop to the notebook, and to the tablet and even the use of smartphones in classrooms (Sheninger, 2014). A review of the literature overwhelmingly determines that student engagement is initially impacted when new technologies are introduced in classrooms (Heaton, 2013). The days of overhead projectors and TVs with VHS systems on rolling carts or even graphic calculators and interactive whiteboards no longer create the cue for students to become engaged (Dunn, 2011). Thus, the type of technology integration that offers sustainable success for student learning and achievement offers varied results (Heaton, 2013).

Finally, much research exists for determining the technology proficiency levels of both teachers and students. In addition, student engagement is a prevalent topic in determining the value that tablet technology adds to the classroom experience for students (Heaton, 2013). Another challenge indicating whether classroom technology integration will be successful or not is teacher buy-in. Spencer (2012) articulated the many reasons teachers refuse to use technology in their classrooms. These reasons range from individual fear and poor personal experiences with technology, to inconsistent paradigms and a lack of credible and relevant research shared with teachers proving its positive impact (Spencer, 2012). Unfortunately, research on which specific levels of technology integration increase student achievement, especially using the most current tablet technologies in one to one settings where the ratio of tablets to students is defined as a 1:1 learning environment, is still limited. This element within the scope of technology’s impact in the classroom often produces contradictory results, and comes with strong opinions on both sides of those for 1:1 initiatives and those against 1:1 initiatives (Heaton, 2013). Thus, the variables contributing to such varied results are the rapid pace at which technology changes, quality training for teachers to integrate such technologies effectively, consistently engaging digital learners, accurate measures of technology integration, and effective digital leadership and support for both teachers and students (Sheninger, 2014). The following review of the literature will examine each of these variables to provide relevance in determining whether specific levels of technology integration correlate to increasing both student engagement and student achievement.

In 1984, public education averaged 1 computer, the Plato, per 92 students (Dunn, 2011). As both desktop and laptop computer technologies advanced, frameworks for technology integration began to emerge (Dunn, 2011). Stoner (1999) created a life cycle model specifically for the integration of learning technology (LT) and the framework for his LT dissemination initiative is illustrated in Figure 1.

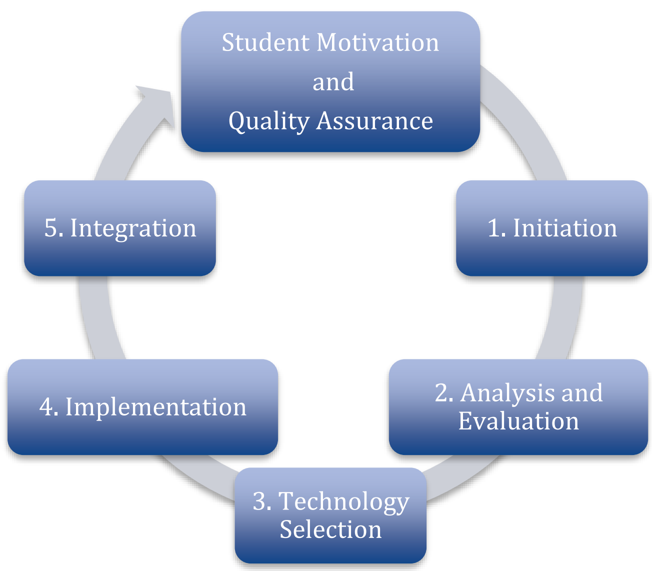

Figure 1. Learning technology integration life cycle (Stoner, 1999)

Although this model for LT integration originated in the decade preceding iPads and other tablet technologies, the framework is still relevant for effective deployment of new learning technologies in educational settings. In each facet of the framework, the variables of recognizing a problem, quality teacher training, selecting the right technologies to engage digital learners, continuously measuring and monitoring progress of implementation, and having the vision and leadership to carry out integration are evident (Sheninger, 2014). Therefore, Stoner's (1999) framework remains applicable to current education initiatives designed to deploy the latest tablet technology to students in classrooms across the nation, especially when student technology proficiency has drastically increased over the last decade.

The LT integration cycle begins with an initiation phase where a specific problem is identified, calling for the need for technology (Stoner, 1999). Tyan-Wood (2016) articulated the modern-day need for technology integration in education to ensure students are prepared to utilize the tools created to continually transform industry. Once this problem is identified, such as greater than 50% of a student population not meeting achievement standards, it takes what Couros (2015) defined as an innovator's mindset to complete the second phase of the cycle, i.e., analyze and evaluate which objectives and actions are necessary for effective LT integration (Stoner, 1999). Considering what Sheninger (2014) emphasized as strong digital leadership, the third phase of the cycle considers the digital learner and selecting the technological tool best designed to engage and motivate students (Stoner, 1999). As Valentine (2009) noted, when students are highly engaged they are more motivated. Therefore, using technology tools at levels of integration relevant to their interests and proficiencies generates higher levels of engagement.

The second phase of Stoner's (1999) LT integration cycle embodies the importance of quality teacher training to ensure that learning activities are designed appropriately for students using the new technology and are continually assessed for effectiveness. This phase includes the action steps of the implementation with strong design for integration at the core (Stoner, 1999). This parallels what Sutton (2015) stressed was essential for achieving learning gains with any new technological tool, strong implementation hinged on quality teacher training.

Finally, and most pertinent to the purpose of the present study, is the last step in the LT integration cycle, which is monitoring integration (Stoner, 1999). This step is listed as the final step in the process, yet is pivotal to the cycle's effectiveness in sustaining successful LT integration. Just as Leys (2016) expressed the importance of monitoring technology integration to ensure the tool truly enhances the learning experience for all students, this crucial phase of the framework recommended both formal and informal monitoring of implementation to be continuous (Stoner, 1999). In addition to continuous monitoring of implementation, it is also essential for technologies to be constantly updated, and remain current with the software, programs, and technological devices that best serve instruction and learning (Sheninger, 2014).

Evident within Stoner's (1999) framework is the complexity involved to ensure technology integration yields positive results for students. This quality assurance hinges on constant evaluation of the process at each phase of the integration cycle (Stoner, 1999). Thus, monitoring the effectiveness of technology integration in improving student engagement and achievement is still relevant to 21st century educational organizations (Sheninger, 2014). The growing importance of this topic is rooted in the rapid pace at which technology has evolved in every facet of society, as very few jobs are free of some type of technology usage (Sheninger, 2014). To prepare students to be competent citizens in the 21st century world of employment, educational organizations are charged with making major paradigm shifts.

Within the context of such shifts in preparing students to be technology proficient problem solvers and critical thinkers is the reality that many students are still struggling to meet proficiency in ELA and mathematical content areas of study (ZoomWV, 2016). Thus, the goal of increasing technology integration in educational settings does encompass students acquiring technology competencies; however, this should not be the sole purpose. The difference between many rural and urban areas, as well as people of various socio-economic statuses, creates a digital divide in their varying levels of access to the Internet and current technologies (Technopedia, 2016). This focus should rather be ongoing and in conjunction with "reducing the digital divide between individuals and social groups; and improving educational practices and academic achievement" (Valiente, 2010, p. 7).

Transforming traditional classroom learning environments for students is also within the scope of goals and objectives for technology integration initiatives in schools (Sheninger, 2014). An example of a modern transformation of a classroom's learning environment is 1:1 technology integration. In this type of educational setting, every student is given a technological device. The devices most commonly utilized in 1:1 settings are laptop computers, digital notebooks, and tablets (Sheninger, 2014). Thus, if an entire school district provides an iPad to every teacher and student to be readily utilized in the educational environment, the organization is considered a 1:1 school.

Increasing the availability and opportunity for personalizing education via technology is ideal; however, students' gains are not guaranteed without strong implementation of the technology from highly trained staff (Sutton, 2015). Therefore, if middle school organizations housing students struggling to meet proficiency in ELA and math are a part of a 1:1 iPad technology integration initiative, training teachers and determining what levels of technology integration produce gains in achievement becomes relevant (S-ABC, 2016). Thus, increasing achievement levels of all students, especially students not meeting proficiency in the assessed content areas of ELA and math requires measuring how technology is impacting the progress toward increasing achievement (Valiente, 2010).

To evaluate the impact of technology on both student engagement and achievement effectively, finding a uniform measure is a necessity. The validity of such a measure can then be translated to providing ongoing feedback to teachers carrying out the goal of using iPads as a technological tool for improving student achievement (Puentedura, 2014). Understanding the levels of technology integration and how to align integration with curriculum of core content areas then becomes an essential component of professional development for teachers charged with utilizing tablets to increase student achievement (Valiente, 2010). This need around technology integration brings relevance to researching and generating quantifiable data on the levels of technology integration and student engagement, and how those levels relate to student achievement.

Additionally, supporting teachers and students in adapting to technologically enhanced classroom environments requires administrative support (Anderson, 2014). This support requires the digital leader to be an active learner, have a growth mindset, and both design and participate in professional development (Fullan, 2014). Consequently, a justifiable approach for determining whether 1:1 iPad technology can be an effective tool for increasing student achievement of middle school students in both ELA and math includes effective professional development for teachers, support from a digital leader, and analyzing data on student engagement using an established protocol, e.g., Valentine's (2009) IPI, alongside data utilizing a model for measuring levels of technology integration, e.g., Puentedura's (2014) SAMR model.

Review of Research Literature

Quality Teacher Training

The impact a teacher has on a student can go one of two ways. It can be incredibly positive, e.g., enabling the child to have social, emotional, and intellectual gains, or incredibly negative or even detrimental to the development of the child (Tucker & Stronge, 2005). One element enhancing the effectiveness of any teacher is the tools at his or her disposal. In the 21st century classroom, technology tools are a part of teachers' repertoire to varying degrees of success. In the words of Roth (2014), "Integrating technology is no longer a choice. It has become too prevalent in the jobs students are being prepared to seek in the 21st century workplace. Reducing fear of teachers and increasing curiosity are two key elements in the path to teachers integrating technology with success" (p. 3).

Unfortunately, despite teachers readily using technology for personal use, Chen (2008) demonstrated that what teachers practiced and what they believed regarding technology were misaligned. Pedagogical practices contradicted pedagogical beliefs, and a combination of poor professional development and misunderstanding of constructivist instruction generated this imbalance (Chen, 2008). Avoiding poor professional development requires a conscientious approach to implementation design. Within Stoner's (1999) model for effective LT integration, the steps regarding selection, design, and implementation of technologies require including staff in deciding what technology will be most effective and how it will be applied for learning, and then training staff accordingly.

Additionally, the transition to more effective technology integration also requires a mindset shift. Specifically, Couros (2015) outlined the importance of defining innovation as a way of thinking. As a result, this way of thinking plays a vital role in the cognitive approaches teachers utilize in designing digital lessons aligned with content-area curriculum. With an innovative mindset, technology integration then becomes an effective tool to empowering students, thus producing increased engagement and learning (Couros, 2015).

This paradigm shift in teaching is also indicative of what Pasgaard (2013) referred to as moving from a monological form of teaching to a polyphonic approach. Monological forms of teaching rely heavily on the teacher being the sole bearer of knowledge, and then distributing that knowledge to students in a one-dimensional fashion Pasgaard, 2013). In contrast, the polyphonic approach to teaching is defined by a mutuality in collaboration and content contribution shared between teacher and student (Pasgaard, 2013). The knowledge sharing and knowledge creation between teacher and student is encouraged, welcomed, and equal (Pasgaard, 2013). This requires teachers to move beyond simply providing an education to students, and move towards the concept of facilitating innovative learning opportunities for students to create an education for themselves (Couros, 2015). This is best illustrated in Figure 2, which diagrams the relationships within the polyphonic form of teaching.

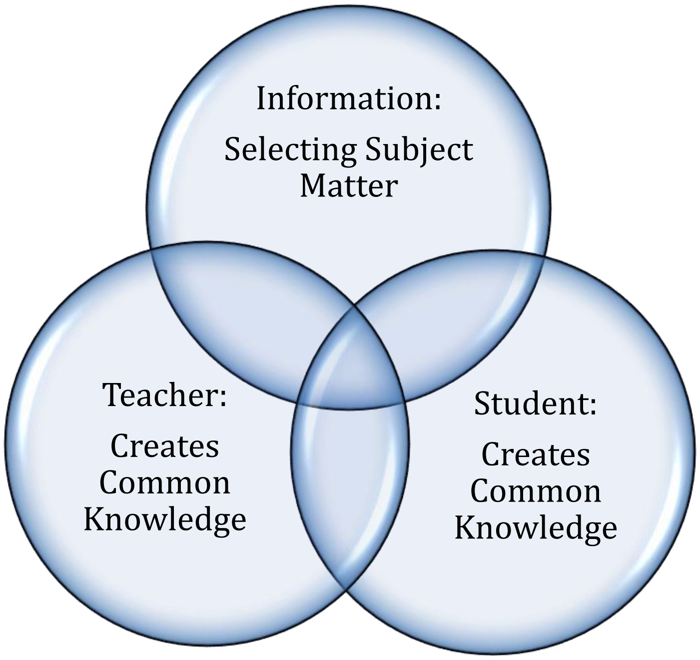

Figure 2. Polyphonic teaching (Pasgaard, 2013).

Theis (2016) evidenced the continued struggle of teachers to find meaningful ways to facilitate student technology use for increasing learning. Yet, a review of studies on the impact of digital technology on students confirmed that training and professional development for teachers was at the heart of every successful initiative. If the training was driven by the goal of, "going beyond the teaching of skills in technology, and focus on the successful pedagogical use of technology to support teaching and learning aims" (Higgins, Xiao, & Katsipataki, 2012, p. 4), then the professional development was meaningful to teachers. Therefore, Theis (2016) emphasized, "Districts need to establish policy that mandates professional development opportunities, time for teachers to develop their own technology skills, and training to learn specific strategies and techniques for integrating technology" (p. 101).

Another challenge often prohibiting smooth transitions with teachers integrating technology for student learning is teachers knowing where to begin. It is easy to become overwhelmed with all the available choices of technology as "competency in technology takes time, patience and practice" (Roth, 2014, p. 5). To address this challenge, the work of Lewis (2010) referenced the importance of differentiation in teacher training for technology usage in classrooms. Specifically, individualized training is beneficial to teachers as a "one-size-fits-all approach is not successful due to teachers being at varying levels of technology proficiency" (Lewis, 2010, p. 42). Further, there is a gap in how teachers teach with technology and how students learn with technology (Lewis, 2010). Garnering teacher and student perceptions on technology usage and integration for learning builds the necessary efficacy to close this gap. Fisher (2010) noted, "When teachers are given the opportunity to influence important school decisions, they also tend to hold stronger beliefs in the collective capability of their faculty" (p. 44). Teacher-to-teacher trust is also vital in the competency, confidence, and success when taking on new initiatives and working together to meet goals (Fisher, 2010).

Finally, to overcome obstacles for teachers integrating technology, discovering their perceptions and attitudes will enhance motivation for usage (Griffin, 2014). A common misconception is that teachers do not want or are not willing to receive more training. Rather, teachers desire training to build confidence with incorporating new technology devices; however, the professional development needs to be meaningful (Pepe, 2016). Thus, quality teacher training is one of the essential components for successful technology integration. Seeking the perceptions of teachers' needs regarding professional development further supports identifying the levels of technology best suited to increasing both student engagement and student achievement (Pepe, 2016).

Engaging Digital Learners

According to Tyan-Wood (2016), “In the last 20 years, we have built a massive body of knowledge and incredible tools to allow anyone to access it from anywhere at any time. It has transformed every industry. Shouldn’t we harness it to raise the smartest, most inquisitive, creative, and educated population in history?” (p. 6). The response to this question is the cause for the influx of technology tools in schools and its latest form is tablets. Tablet technology is still new to the classroom and the debate of its effectiveness continues. For example, in 2012 *The New York Times* published an article referencing studies that the Pew Research Center and Common Sense Media conducted on teacher perceptions of students with respect to technology use (as cited in Richel, 2012). The article noted teacher perceptions are often contradictory; however, it validated that teachers are at a crossroads of assuming students have shortened attention spans from too much technology usage versus realizing children process information differently than in the past (Richel, 2012). Similarly, a 2013 *Bloomberg Businessweek* article claimed technology in the classroom is another “false promise” in education as it noted computers as another “quick fix” to the perception of an “educational crisis” of too many students underachieving (Kenny, 2013).

However, in more recent articles on technology integration for the sake of the digital learner and preparing students to be successful in the digital world, it is all about balance. DeLoatch (2015) referenced the negative aspect of too much technology usage or screen time changing the way students think and feel. In addition, the researcher noted the importance of monitoring, technology used with specific intent, educating students about responsible usage, and offering alternatives to technology so that negative side effects are avoided (DeLoatch, 2015). In addition, Leys (2016) claimed with proper monitoring, technology is an extremely useful tool that can generate enhanced educational experiences for all students of varied abilities. App addiction, mobile gaming, and device distraction are difficult to avoid with over one million apps available in the Apple app store; however, these can be combatted with moderation (Leys, 2016).

Thus, balancing how to incorporate technological tools is foundational to facilitating the 21st century learning environment designed to engage digital learners. Specific to 1:1 initiatives, Sutton (2015) determined the strength of implementation across a span of several studies of such initiatives possessed the common denominator of strong professional development. Greatly emphasized in this article was the subjective belief that giving all children a computer or tablet will increase academic achievement and is a necessity owing to the ever-evolving technological society (Sutton, 2015).

Moving to the importance of social learning with respect to modern technology integration in the classroom revives the importance of social influences foundational to the social cognitive theory (Koch, 2016). The opportunities for students and teachers to interact socially online enhances learning via connections never possible before, such as global networking and educational gaming (Koch, 2016). Although face-to-face communication is still pivotal to the social development of the whole child, Koch (2016) evidenced many students who may have previously been uncomfortable in "live" social settings, gain from social learning experiences with online communications.

In contrast, other studies have shown that engaging digital learners with the most up-to-date technologies can backfire. Murphy (2014) noted one US school district packed up and shipped out their iPads to trade them for Chromebooks. The Hillsborough

School District's Director of Technology claimed students viewed the iPad as an entertainment and fun device, whereas the Chromebook was viewed as a work tool (Murphy, 2014). Similarly, Hu (2011) referenced the debate on the cost-benefit analysis of iPads. The article admitted iPads are marvelous tools for increasing student engagement, but quickly focused on the novelty of the devices wearing off (Hu, 2011). Furthermore, despite South Carolina teachers believing that iPads are an excellent tool for increasing student engagement, they were uncertain about increases in student achievement from utilizing them in their studies (Heaton, 2013). Jennifer Magiera, a digital learning coordinator for Chicago public schools, also shared reservations on iPads increasing student achievement. When she simply substituted technology for what she already did, it had no impact; however, when she utilized iPads to differentiate instruction and provide students with opportunities to create, this increased both student engagement and student achievement (Heaton, 2013).

Additionally, Heaton (2013) referenced an ELA teacher from South Carolina who had recently undertaken a 1:1 iPad initiative and was at first skeptical of the tool for learning; however, she eventually claimed that she never wanted to go back to not using iPads. She valued offering students immediate feedback, tailoring lessons to student needs, and believed rather than "jamming information down their throats, iPads generate more active participation and student-driven instruction" (Heaton, 2013, p. 3). The increased learning opportunities and increased student engagement technology integration affords students is also aligned with being mindful of student motivation (Stoner, 1999). As noted in the LT integration cycle, Stoner (1999) illustrated the importance of this consideration being connected to all facets of the implementation process. Thus, after adjusting to the new innovative tool, the iPad, enhanced instruction for student engagement and increased achievement is necessary for the same reason it has always been necessary, for students, the greatest resource impacting posterity.

Simon Sinek's (2011) work focused on the importance of having what he called a personal why factor, i.e., an intrinsic purpose or reason for doing what an individual chooses to do. He claimed people do not buy into what an organization does; rather, they buy into the underlying reason or core beliefs and purpose of the organization (Sinek, 2011). This statement is powerful in its adaptation to galvanizing members of an organization for a cause. Students are the most necessary cause for changes in education. If the way students learn changes and if the world they are expected to thrive in changes, then the art of teaching must shift appropriately. As Sheninger (2014) referenced, "For many students, school does not reflect real life. Students want to be creative, collaborate, utilize technology for learning, connect with their peers in other countries, understand the messages that media convey, and solve real-world problems" (p. 134). Therefore, engaging the digital learner is at the center of determining the levels of technology integration that are most impactful for increases in student achievement.

Measuring Technology Integration

The goal of making tablets work should be predicated on, "engaging every student at the level where they are able to learn, when they are ready to learn" (Tyan-Wood, 2016, p. 4). Determining what levels of technology integration do just that is an ongoing challenge for schools immersed in 1:1 initiatives. This challenge validates the call for more research on effectively measuring technology integration. Aside from the constant variable of student motivation considerations, Stoner (1999) also emphasized the need for constant evaluation of implementation within his cycle. Determining which tool or method will accurately evaluate the effectiveness of technology integration becomes relevant.

In 2006, Ruben Puentedura designed a platform for such measurement referred to as the SAMR (Substitution, Augmentation, Modification, and Redefinition) model (Puentedura, 2014). This hierarchy begins with substitution, the basic level of technology integration without functional change, and moves toward the most desired level, redefinition, i.e., technology integration allowing for the creation of tasks not previously possible without the use of technology (Romrell et al., 2014). Although the model itself helps, the plethora of options in technology integration often lead teachers into a revolving door of ongoing substitutive uses of technology. This then prohibits the possible and desired transformative outcomes technology can provide for increased student learning (Puentedura, 2014).

To enhance the SAMR model, Puentedura (2014) added a familiar formula to it. Bloom's taxonomy is a teacher's essential tool for understanding how specific classroom activities engage students in fostering specific learning experiences ranging from a basic recall or knowledge level to a higher-order thinking level incorporating synthesis and evaluation of content. Thus, the already familiar drive to reach the upper levels of Bloom's taxonomy now also acts as a drive to reach the upper levels of SAMR (Figure 3; Puentedura, 2014). In a review of the SAMR framework for measuring technology integration for learning, positive benefits such as increased engagement were noted at the substitution and augmentation levels; however, modification and redefinition levels transformed learning at a faster and more meaningful rate (Romrell et al., 2014). Further, at the redefinition level, learning was, “personalized, situated, and connected” and therefore “purposefully designed” to have the effect of transformative learning (Romrell et al., 2014, p. 9).

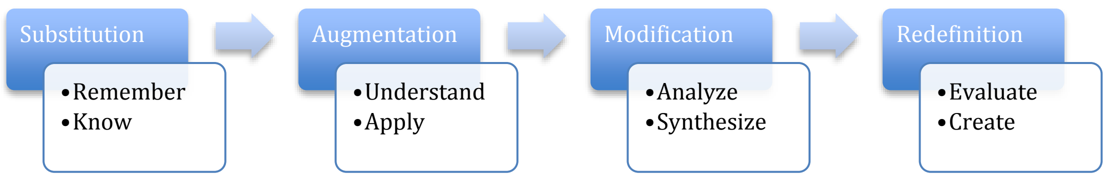

Figure 3. SAMR aligned with Bloom’s taxonomy (Puentedura, 2014).

Despite the SAMR model making great strides in identifying the most effective level(s) of technology integration, research determining how the integration directly correlates to student achievement is still limited. Specifically, according to Carr (2012) implementation of tablets and game-based learning in math does show learning gains; however, determining its statistical significance with respect to student achievement as measured on summative state assessments remains a challenge. Valiente (2010) also claimed more knowledge is required in determining the relationship between student academic gains and technology integration. In a review of 1:1 initiatives, although the primary goal was to improve both educational practices and the academic achievement of students, there was still a need to “identify best practices of 1:1 initiatives to make informed policy decisions” and “monitoring and evaluation practices need to play an important role” (Valiente, 2010, p. 16).

Moreover, in an article addressing the data collection process for measuring technology integration, Bebell, O’Dwyer, Russell, and Hoffman (2010) conveyed concerns. Specifically, data from surveys alone do not provide sufficient evidence on the outcomes of educational technology. To "adequately estimate any potential impact of educational technology on student learning, all measures of educational outcomes must first be carefully defined and aligned with the specific uses and intended effects of a given educational technology" (Bebell et al., 2010, p. 42). Likewise, a 2013 study by Storz and Hoffman examined the response to a 1:1 initiative and stressed the need for stronger studies on the effects of integration on student achievement, but not to discredit the need for listening to the voices of both students and teachers in the process. Consequently, measuring the impact of technology integration on student engagement and achievement is not a definitive process. As technology evolves, the processes of monitoring the results are also evolving, which verifies the need for continued research on how best to measure technology integration for increased student engagement and achievement (Storz & Hoffman, 2013).

Digital Leadership

A final variable in this review of the literature pertinent to determining what levels of technology integration increase both student engagement and achievement is digital leadership. Without the educational leader's vision for how technology integration can transform learning for students, the implementation will most likely fail (Stoner, 1999). This is the rationale for Stoner's (1999) initiation phase being the first step in his model for LT integration, as it emphasized recognizing potential problems and possibilities as part of assessing the situation prior to beginning implementation. Eric Sheninger has become a modern authority on the paradigm shifts in leadership necessary to accommodate the education of digital learners. His book outlined the responsibility of principals in cooperation with educational leaders of the classroom to focus on student engagement and enhanced learning utilizing technology (Sheninger, 2014). In addition to facilitating meaningful professional development, “collaboration is vital” as well as “digital partnerships” to foster successful technology integration (p. 134). In addition, in a subsequent article outlining the pillars of digital leadership, Sheninger (2014) noted, that leaders need to be the catalysts for change and are responsible for transforming their respective students and schools to generate learners with essential digital age skills. This type of leadership is necessary for guiding effective change, especially with respect to adapting to new technologies such as tablets in the classroom. Redditt (2007) focused on the process for training prospective principals and emphasized the trickle-down-effect of what the principal makes a priority. The study revealed that teachers, as do students, emulate what the principal does to generate a more pervasive change in any initiative, but especially regarding technology integration (Redditt, 2007). Fullan (2014) also noted that for principals to have an impact on making positive changes, collaboration around change is essential. Gaining the commitment to change is more meaningful than compliance and can be sustained through being a leader of learning, “If you learn alongside teachers, you learn with them what works and what doesn’t, and it is powerful for meaningful change” (Fullan, 2014, p. 56).

Finally, from the words of principals nationally recognized for their excellence in digital leadership in 2016, fostering positive relationships, facilitating proper training and support, and monitoring results fall on the shoulders of the principal (Dodd, 2016). These elements should be implemented with a collaborative mindset and shared leadership; however, the ultimate accountability for creating the culture and environment necessary for breeding success lies with the principal as the primary digital leader (Dodd, 2016).

Three tenacious trailblazers recognized as the 2016 National Association of Secondary School Principals Digital Principals were Winston Sakurai, Bobby Dodd, and Glen Robbins. A common denominator among the success of these three individuals is communicating high expectations for achievement and success alongside an expectation for failure (Dodd, 2016). Empowering students to fail as they work on projects and as they work on teams, so they understand how to problem solve effectively and grow was also vital in the success of increased technology integration (Dodd, 2016). Lastly, and most importantly, Robbins, a middle school principal adamantly noted, “technology is the tool for empowerment and access to resources for students, not the driver of pedagogy” (p. 28).

As Dodd (2016) articulated, “never assume kids can’t do something, students have proven for years that they can do anything.” Therefore, “we need to provide opportunities for students so they will be successful later in life” (Dodd, 2016, p. 32). Digital leadership along with quality teacher training, and a commitment to engaging the digital learner, support the valid need for defining accurate measures to determine the most effective levels of technology integration increasing student achievement.

Review of Methodological Issues

In 2009, tablet technology was not yet prevalent in the classroom. In fact, the iPad was not released until 2010 with version iOS 3.2 (Nations, 2015). As a result, many studies conducted even in the last five years regarding 1:1 technology implementation were predicated upon the use of laptops or basic tablets. Now, according to a 2014 article on best practices with tablets in the classroom, over 3.5 million students have been introduced to using iPads in school (Noonoo, 2014). As stated previously, the standard operating system of the original iPad was iOS 3.2 (Nations, 2015). Currently, after checking both a personal iPhone and iPad, iOS 9.3 is the latest version; however, this will change by the completion of this dissertation (Nations, 2015). It is a challenge for research to keep up with the pace of technology's constant updates. Constant updates in technology programs for educational settings can hinder both teacher and student abilities to maintain proficiency and competence in usage (Sheninger, 2014). However, examining quality research for utilizing 1:1 technology to improve 21st century classrooms is an essential guide to overcome challenges and guide future research endeavors.

After analyzing specific studies, articles, and reviews of the current literature on technology integration, several themes were revealed. Many studies focus on teacher and/or student proficiency with respect to technology. These studies often include the frequency of usage and the types of technologies utilized in the classroom. Additionally, much qualitative data exists on both teacher and student perceptions regarding how technology changes the classroom environment and student engagement (Richel, 2012).

Knowledge of teacher and student proficiency levels, as well as their perceptions of using technology in the classroom are both beneficial; however, a large body of research analyzing *how* specific types of technology are implemented rather than *what* types of technologies are implemented by teachers and practiced by students is lacking (Romrell et al., 2014). Quantitative data on what specific technology levels impact student achievement is also lacking (Leys, 2016). Narrowing this focus to 1:1 technology settings, classroom environments where every teacher and student has an iPad within middle level educational organizations reveals even more limited results. Therefore, the following analysis of methodological issues illuminates the need for refined quantitative approaches to determining what levels of technology implementation have the greatest potential for increasing both student engagement and achievement.

Technology Integration Perceptions, Proficiency, and Usage

Determining which factors predict quality usage in classrooms is important knowledge pinpointing the barriers that may exist in the process to effective technology integration. Hastings (2009) and Valiente (2010) utilized qualitative methods to analyze the areas of proficiency, usage, and types of technology, but also assessed how these variables impacted student performance. However, analyzing how well, how often, and which types of technology are utilized does not include the level of technology integration. Simply stated, this analysis does not reveal what effective technology integration looks like and the effects it may or may not have on student engagement and achievement (Hastings, 2009).

Furthermore, the limitations of the studies regarding technology's effect on student performance included variables altering specificity. These variables included teacher experience with technology, teacher training, content area expertise of the teacher, and inconsistencies in the availability of technology (Hastings, 2009). A conclusion drawn from the research of both Hastings (2009) and Valiente (2010), which analyzed collections of surveys from teachers and students, was the recommendation for more emphasis to be placed on evaluating how technology is applied and tracking the results. This shift in emphasis could then translate to how technology is being utilized and how such usage correlates to possible increases in student learning and achievement (Hastings, 2009). Thus, Hastings (2009) and Valiente (2010) examined a large body of qualitative data worldwide regarding 1:1 initiatives, which predominately included 1:1 usage with laptop computers. They determined that more research is necessary regarding the relation between implementation of technology and academic gains that specific implementation strategies produce.

A more recent qualitative analysis applying surveys and a phenomenological design produced new knowledge on the perspective of both students and teachers who undertook a 1:1 iPad initiative for grades six to eight in an urban school district (Theis, 2016). The pre- and post-surveys of both students and teachers produced data from before and after the pilot year of the 1:1 initiative (Theis, 2016). The research concluded that teachers and students agreed the initiative provided new and creative ways of demonstrating learning, such as students generating digital products as authentic assessments and students validating reasoning via online research (Theis, 2016). This paralleled findings from the studies by Hastings (2009) and Valiente (2010) that reiterated how the initial increase of technology in classrooms subsequently increases engagement. Although these conclusions provide important knowledge in designing professional development for teachers, and insight into what makes a 1:1 initiative work for both teachers and students, measuring student achievement gains with the implementation of technology tools is still missing.

Technology Integration and Increased Learning

More research in the arena of 1:1 technology settings increased by 2012 and consequently afforded researchers with the opportunity to review a larger body of quantitative data (Higgins et al., 2012). In these 1:1 classroom environments, Higgins et al. (2012) and Rosen and Beck-Hill (2012) tested students for gains in achievement in core content areas of study including ELA, math, and science. After comparing the achievements of students prior to the 1:1 technology implementation with their achievements after the 1:1 technology implementation, students demonstrated greater gains in these core content areas after implementation of 1:1 technology (Higgins et al., 2012; Rosen & Beck-Hill, 2012).

In addition, the studies by both Higgins et al. (2012) and Rosen and Beck-Hill (2012) validated the constructivist learning method approach, in conjunction with 1:1 technology using laptop computers with a specific control group versus an experimental group. Both studies drew quantitative data from end of year assessments and determined positive correlations between achievement results of experimental groups and those of control groups (Higgins et al., 2012; Rosen & Beck-Hill, 2012). In the experimental group of nearly 500 fourth and fifth grade students in Dallas, TX the students demonstrated greater gains in both ELA and math achievement when technology was utilized (Rosen & Beck-Hill, 2012).

Higgins et al. (2012) yielded similar results with a control group from middle level grades six through eight; however, greater gains were found in math and science, as opposed to literacy, and greater gains in writing compared to the ELA areas of reading and spelling (Higgins et al., 2012). Despite encouraging results advocating technology as a tool to increasing student achievement in 1:1 classroom settings, the technology utilized was a scripted curriculum (Higgins et al., 2012). Thus, the teachers had little flexibility and choice in how to integrate the types of technology using laptops (Rosen & Beck-Hill, 2012). The quantitative data demonstrated gains in achievement; however, the type of technology integration analyzed was one-dimensional and the bulk of the data that Higgins et al. (2012) and Rosen and Beck-Hill (2012) reviewed was derived from students who utilized laptops with keyboards. Unfortunately, these studies did not produce data on 1:1 classroom settings using iPads, digital tablets, or any type of touch-screen technology.

Fortunately, studies on specific applications designed for iPads in the classroom began to emerge. For example, Carr (2012) analyzed whether game-based learning could increase achievement in math for fifth grade students or not, and Lopuch (2013) measured how multiple applications impacted student engagement and achievement. Carr (2012) analyzed the effectiveness of game-based math applications designed for iPads. The study included an experimental group of students who utilized iPads during math classes compared to a control group who did not use iPads during math classes (Carr, 2012). Interestingly, the researcher provided post-test data showing no statistical significant differences in achievement scores of students in the experimental group using game-based math applications on iPads compared to scores of students in the control group (Carr, 2012).

Both Carr (2012) and Lopuch (2013) emphasized how specific iPad applications can be measured for both student engagement and achievement. However, Carr (2012) focused on one type of game-based application and its effect on math achievement only, whereas Lopuch (2013) collected data on different types of apps to gain a greater scope on how they would affect multiple areas of achievement. In addition, Lopuch (2013) examined students from both primary and secondary levels. Using a database, the researcher collected 140,000 observations of students utilizing 663 educational apps (Lopuch, 2013). The quantitative data collected supported measurable growth in ELA and small growth in math when both the apps students utilized were aligned with specific weaknesses of students, and students gave the apps a high rating (Lopuch, 2013). The gains were also higher in primary level students than in secondary level students, and a moderately positive relationship between achievement growth and engagement was demonstrated (Lopuch, 2013). This study evidenced the importance of curriculum-aligned applications; however, its focus was on the effectiveness of the app(s) itself as opposed to the specific level of technology integration facilitated within classroom activities.

Finally, Bello (2014) applied a questionnaire for teachers designed to determine what specific levels of technology integration was utilized in their classrooms. Taking a similar approach to that of Carr (2012) and Lopuch (2013), the quantitative comparative analysis of rural high schools in Nigeria revealed the presence of technology in schools versus no presence of technology had an obvious impact on increasing both engagement and achievement (Bello, 2014). The study also noted the overall levels of technology integration utilized by teachers were low; however, once again this came from teachers rating themselves on what types of technology they utilized and how often they utilized those technologies (Bello, 2014). Consequently, the quantitative data analysis concluded the level of technology implementation did not influence student achievement (Bello, 2014).

Thus, in reviewing the methodological approaches to determining the impact of 1:1 initiatives on student engagement and achievement, several common strategies reveal conflicting results. The qualitative approaches of Hastings (2009), Valiente (2010), and Theis (2016) that focused on frequency of usage and proficiency provided powerful insights into teacher and student perceptions on 1:1 technology in classroom environments. The quantitative approaches of Higgins et al. (2012) and Rosen and Beck-Hill (2012) evidenced how 1:1 technology integration increases learning in core content areas of knowledge compared to students without 1:1 technology integration; however, consistencies in gains across all content areas of knowledge were lacking. Lastly, while Carr (2012), Lopuch (2013), and Bello (2014) all analyzed impacts of 1:1 technology integration using tablets and specific applications, each study produced one-dimensional data on different student groups. These conclusions warrant a need for new methodological approaches in researching 1:1 technology, and moving beyond surveys and questionnaires to introduce credible observation tools for researchers to gain new knowledge on what is happening in classrooms that are mastering effective technology integration (Puentedura, 2014). Therefore, developing an observation tool designed to produce descriptive data on the levels of technology integration present in classrooms and comparing those observations to student assessment scores would reveal new insight into how specific technology integration correlates to student achievement.

Synthesis of Research Findings

The body of research available in technology integration in educational organizations continues to grow at a rapid pace. Sifting through this research to find the most current studies relevant to the myriad of processes connecting students to constant access to technology for learning in 1:1 settings produced interesting results. Specifically, four claims are supported after review of how to effectively support student engagement and achievement in classrooms where every student and teacher use a technological device. These are quality teacher training, engaging the digital learner, measuring technology integration, and digital leadership, which all contribute to the success of improving student achievement within the context of a 1:1 technology initiative (Sheninger, 2014).

These claims follow a logical progression beginning with the most impactful variable on student achievement, the teacher (Tucker & Stronge, 2005). If the role of the teacher does not undergo a mind shift to accommodate the needs of the 21st century student, any new pedagogy, curriculum, or 1:1 initiative will ultimately fail (Blair, 2012). Educational researchers, leaders, and teachers agree and are willing to be trained; however, the essential component is that the training must be relevant to the teacher to be effective (Pepe, 2016). Quality over quantity is also a factor in ensuring teacher training for integrating technology meets the needs of the teacher, while empowering the teacher to engage students with new technologies such as tablets in the classroom (Blair, 2012).

Regarding engaging digital learners, the research reiterates that the time is now. If third graders are texting on smartphones, kindergarteners are navigating iPads, and middle students have blog and YouTube channel followings, then what goes on in classrooms to engage these students must change (Blair, 2012). Moreover, "These new 21st century learners are highly relational and demand quick access to new knowledge," and "they are capable of engaging in learning at a whole new level" (Blair, 2012, p. 1). Although DeLoatch (2015) emphasized the negative factors associated with placing hand-held technology in every school, such as students' accessing dangerous information and devices being distractions, the importance of equipping students with the technologies they will utilize in the 21st century world of employment far outweighs the risks (Tyan-Wood, 2016).

Thus, the research suggests a new trust is called upon in the form of a new teaching model to engage students, which is termed polyphonic teaching (Pasgaard, 2013). The former hierarchy of teachers being the universal source of content knowledge facilitating the creation of new knowledge for students is no longer relevant. As a result, the teacher and the student model shifts to a more equal playing field of collaboration, knowledge sharing, and knowledge creation (Pasgaard, 2013). When trust is established, the polyphonic model for teaching enables a technology-rich classroom to be transformed. No longer are technology resources simply substitutions for textbooks, DVDs, and board games, but rather technology provides all learners with gateways to innovative social learning environments (Koch, 2016). In addition, it increases the opportunity for personalized learning and differentiated instruction for all students (Leys, 2016).

Now that teachers have been trained and students are engaged, determining accurate measures of what defines effective technology integration is essential for monitoring progress toward sustainable success (Romrell et. al., 2014). As new technologies are placed in schools, new models emerge for how to best monitor and measure the success of their implementation (Puentedura, 2014). In addition to aligning these measures with curriculum goals for student outcomes, determining the measures to monitor the form and function of the technology is essential (Weston & Bain, 2010). Although they are difficult to conduct, program evaluations for measuring the effectiveness of technology integration, not limited to 1:1 classroom settings in schools, are needed to warrant investment in such technology integration (Valiente, 2010). The necessity for effective measures is part of the “holistic perspective necessary for 1:1 initiatives to be drivers of educational change in schools (Valiente, 2010, p. 16).

Finally, digital leadership cannot be ignored (Sheninger, 2014). If teachers are called upon to learn new pedagogy, processes, and master technological tools for enhanced curriculum delivery, leaders are called upon to support the learners. More importantly, the effective 21st century educational administrator is a leader of learning as a lifelong learner (Fullan, 2014). Additionally, modeling and facilitating collaboration opportunities for teachers to adapt to incorporating higher levels of technology integration is critical. However, at the core of this shift is ensuring technology is being utilized as a tool for empowerment and a resource for both teachers and students, rather than the driver of pedagogy (Dodd, 2016). This strategy is necessary to support improvement in both student engagement and achievement (Sheninger, 2014). Thus, strong digital leadership is foundational to support the role of the teacher in engaging digital learners, and to monitor effective technology integration for increased student engagement and achievement (Dodd, 2016).

Critique of Previous Research

After a review of the current literature, the value of technology in classrooms as a powerful tool to increase student engagement in learning has been established (Heaton, 2013). Clearly, the role of a quality teacher in the success of a child is pivotal (Tucker & Stronge, 2005). Subsequently, for technology integration of any kind or level to be successful, meaningful professional development for teachers is essential (Griffin, 2014). In addition, utilizing the most current technological tools in the classroom makes schools more relevant, engages digital learners, and better prepares those learners for the 21st century world of employment (Tyan-Wood, 2016). Applying those new resources requires educators to determine the effectiveness of the technology integration via continually monitoring for results (Bebell et al., 2010). Technology integration can have positive impacts on student learning; however, determining what level of technology yields what specific learning gains is still unclear (Heaton, 2013). Therefore, a critique of recent research in technology integration specific to 1:1 initiatives revealed a need for more quantifiable data on determining what levels of technology integration result in positive gains in student achievement.

In a comprehensive review of 1:1 initiatives, Weston and Bain (2010) reiterated the importance of moving beyond technology integration at a level of substitution, i.e., simply automatizing a previous practice. Specifically, enhanced replacements are more engaging; however, they do not necessarily yield change (Weston & Bain, 2010). If someone buys a new car, it may be faster, be more efficient on gas mileage, have a sunroof, and/or Bluetooth; however, its function, objective, and results yielded from the purpose of the car are the same as any previous car, i.e., to get from point A to point B. In addition, the car itself does not change its destination; rather, the driver of the car determines the destination. Thus, if teachers are the drivers of technology integration and facilitating usage in classrooms for students, knowing both how to drive the vehicle and the path to a new destination is essential (Romrell et al., 2014). Knowing what level of technology integration is most effective in driving students to the desired destination of increased achievement is the area of knowledge most inconsistent with a large portion of current research (Heaton, 2013).

Moving beyond inconsistencies on how technology integration impacts student assessment results, information on teacher and student perceptions of technology usage is prevalent in the research community. Unfortunately, student perception of technology does not indicate its effect on student learning and achievement (Valiente, 2010). Specifically, in the personal review of over 30 studies on technology integration in education, 20 qualitative studies focused on teacher and student perceptions, only 5 studies were quantitative and generated inconsistent learner gains using a variety of technologies (laptops and other touch-screen tablets), and 5 mixed-method studies combined frequency of usage with teacher and/or student perceptions. Without determining what specific learning gains can be derived from what specific technology integration, the idea that technology in the hands of every student in every classroom is merely another attempted quick fix for too many underachieving students gains validity (Kenny, 2013).

Finally, a critique of research regarding technology integration in the last five years reveals limited studies on 1:1 initiatives in schools utilizing tablets, which are even more limited in middle level educational organizations. The lack of studies is largely due to the major costs of tablets that are being introduced in schools, and the latest version of the devices still being relatively new to classrooms (Sutton, 2015). However, the claim for the necessity of today's students to be equipped with the latest 21st century technological skills including problem solving, creativity, collaboration, communication, and critical thinking, is the consistent rationale for more research required in what really works in classroom settings (Blair, 2012). Therefore, current research on technology integration in education reveals the need for quantitative studies on the impact of 1:1

technology initiatives in middle level educational organizations, and which specific levels of technology integration show gains in student achievement.

Summary

In their work dedicated to utilizing technology and brain science to engage 21st century learners, Nimz and Michel (2012) emphasized that the time is now. Specifically, even though the "influx of technology" is often viewed as "moving too quickly to process," the opportunity for "our current time as a unique space" can lead to a "renaissance in education" (p. 15). Seizing this opportunity involves high levels of collaboration and overcoming the myriad of challenges associated with organizational change (Fullan, 2014). Moreover, the world is constantly changing and this requires an innovator's mindset (Couros, 2015). As occupants of this world, "developing the skills and mindsets that will help us all thrive" is essential for "empowering students to succeed in school and life" (Couros, 2015, p. 103).

Regarding effective technology integration engaging digital learners and increasing student achievement specific to 1:1 classroom environments, a review of the literature evidences the importance of the role of the teacher, the role of the student/learner, the role of the leader/administrator, and accurately measuring the effectiveness of how the learning tool/technology is integrated. Teachers need quality training relevant to their needs, as their perceptions and proficiency with respect to technology integration impacts student engagement (Roth, 2014). Similarly, all students are not at the same level of technology proficiency, especially in educational settings; however, they desperately need preparation with using digital tools to prepare them for success in the 21st century world of employment (Sutton, 2015). Measuring specific levels of technology integration utilized in 1:1 classroom settings can empower teachers, students, and digital leaders with the knowledge of what levels truly yield learning gains (Romrell et al., 2014). Finally, without an innovative mindset and being a leader of learning and modeling what good technology integration looks like, a successful 1:1 technology initiative will ultimately fail (Sheninger, 2014). These core elements create the framework surrounding the necessity for more research into how to increase student engagement and achievement using technology as a tool to enhance the learning process.

Although a comprehensive review of the literature has validated the importance of technology integration in education, consistent data on what defines sustainable success is still required. The methods utilized to generate the data and the data itself within the framework of the aforementioned elements, do have limitations such as: inconsistent findings on learner gains, limited information on student sub-groups, and the majority of qualitative data revealing teacher and student perceptions regarding 1:1 technology initiatives. These limitations warrant the development of an observation tool designed to determine what level of technology integration is utilized in classrooms and the effects of those levels on student engagement and achievement (Puentedura, 2014). This tool can then be applied to produce data to be compared to student assessment scores to better determine statistically sound correlations on what specific levels of technology integration impact student achievement.

Therefore, as articulated by Nimz and Michel (2012), “Creating learning environments that capitalize on available digital tools which advance learning and sustain students’ motivation is a challenge confronting teachers at all levels” (p. 12). If educational leaders and teachers today are committed to cultivating lifelong learners in all students, knowing how to connect to their lives using the very digital tools that have become a part of their lifestyles is essential (Nimz & Michel, 2012). Simply stated, “If schoolwork is intertwined with today’s technology, it can make a difference in the classroom” (Nimz & Michel, 2012, p. 13). Thus, knowing which specific levels of technology integration can create the biggest difference is critical to the success of how teachers teach and, most importantly, what students can achieve.

Chapter 3: Methodology

Introduction

The world is technology-dependent and its future leaders, i.e., students, need an education infused with the tools and skills associated with this reliance on technology. It is time, "to create and sustain a digital learning culture that is relevant, meaningful, applicable, and provides all students with the skills to succeed" (Sheninger, 2014, p. 2). Sheninger (2014) referenced student engagement and learning as core pillars for digital leadership alongside professional growth and development. Therefore, if a school district mandated the use of technology via a 1:1 tablet initiative, middle schools within that district that are still struggling to meet proficiency in ELA and math as measured by state summative assessments need to know what levels of technology integration best supports the improvement of student achievement (S-ABC, 2016).

Specifically, when greater than 50% of a student population fails to meet the state guidelines for grade-level standards in ELA and math achievement, understanding how the integration of new technologies affects the assessment scores utilized to measure whether students met that standard or not is pivotal. Anderson (2014) indicated, "Technology is powerful. In our day-to-day lives, we are in constant contact with it and some would say we wouldn't be able to function without technology" (p. 38). As a result, educational organizations must shift from determining whether to use technology or not, to knowing what technologies to use, how to use them effectively, and the impact usage has on summative assessments (Anderson, 2014).

The present descriptive research study using Fisher's Exact cross-tabulation statistical analysis was designed to determine the frequencies of specific levels of technology integration using tablets in a 1:1 setting compared to the frequencies of student engagement levels and student achievement results. Using an observation tool to rate the levels of student engagement and technology integration, the ELA and math classroom observations occurred within three middle schools that were failing to meet greater than 50% proficiency in both ELA and math, as measured by state-mandated summative assessments. In addition, the study was designed to determine how those levels of technology integration did or did not relate to increased proficiency on the SBA, the general summative assessment given annually to all students attending public schools in the state of WV (WVDE, 2016). The significance of measuring the impact of technology integration on student engagement and achievement was vital for educators to guide instructional delivery for the improvement of all students (Sheninger, 2014).

To evaluate this impact, a quantitative observation tool measuring student engagement via Valentine's (2009) IPI scale and technology integration via Puentedura's (2014) SAMR model scale were utilized to collect data during classroom observations. The tool measured both student engagement and levels of technology integration present during instruction in middle school ELA and math classrooms. The observation tool utilized the SAMR model, which rates the level of technology integration observed in ELA and math classes on a scale of 1–4 (Puentedura, 2014):

1. Substitution
2. Augmentation
3. Modification
4. Redefinition

The researcher also applied an IPI scale to rate student engagement (Valentine, 2009):

1. Little to no engagement
2. Teacher led instruction with student involvement
3. Students engaged in higher-order thinking, active conversations
4. Students doing work that promotes higher-order thinking

This tool was utilized to collect data from middle school ELA and math classrooms in three middle schools using 1:1 iPad technology, which were all located within the same school district. These middle schools were also identified as having greater than 50% of their student populations not meeting proficiency in both ELA and math on the WV general summative assessment, as measured by the 2015–2016 SBA rating student achievement in levels on the following scale (WVDE, 2016):

1. Has not met the standard
2. Nearly met the standard
3. Met the standard
4. Exceeded the standard

The data collected from the observation tool was then compared to the data derived from the 2016–2017 school year SBA results of the three middle schools observed, to determine if there were any significant relationships or frequencies between levels of technology integration and student engagement in comparison to SBA achievement levels (WVDE, 2016). The researcher was granted access to entire school and individual student assessment scores for the 2016–2017 school year, and was therefore able to disaggregate summative assessment data into the following categories: specific schools, specific grade levels, and specific content areas of ELA and math. Once this quantitative summative assessment data was disaggregated, it was then compared to the quantitative data derived from the observation tools to determine if any significant relationships existed.

Purpose of Study

One purpose of the study was to explore middle school students' engagement levels to levels of technology integration utilized during classroom instruction within ELA and math courses. Another purpose of the study was to analyze the levels of technology integration utilized during classroom instruction in comparison to summative assessment performance levels of middle school students in ELA and math, as measured by the WV general summative assessment, the SBA.

This descriptive study utilized Fisher's Exact cross-tabulation analysis to determine if and to what extent Puentedura's (2014) SAMR model levels of technology integration was related to Valentine's (2009) IPI levels of student engagement. It further analyzed the relationship between Puentedura's (2014) SAMR model levels of technology integration to the SBA levels of student achievement (Lowry, 2014). The analysis of student performance was in the areas of ELA and math, among middle school students in 1:1 iPad settings from middle schools with greater than 50% of students not meeting the achievement standard in both ELA and math as measured by the SBA (WVDE, 2016).

Research Questions

Q1. To what extent, if any, is there a statistically significant relationship present between middle school students' levels of engagement and levels of technology integration during content area instruction of ELA and math classes, as measured by a SAMR model instructional practice inventory?

Q2. What is the relationship between middle school students' summative assessment performance, in the areas of ELA and math, and levels of technology integration during content instruction of ELA and math?

Research Hypothesis

H1a. There is a statistically significant relationship present between middle school students' levels of engagement and levels of technology integration during content area instruction of ELA and math classes, as measured by a SAMR model instructional practice inventory.

H1o. There is no statistically significant relationship present between middle school students' levels of engagement and levels of technology integration during content area instruction of ELA and math classes, as measured by a SAMR model instructional practice inventory.

Research Design

The descriptive research design with statistical analysis was chosen because of the small sample size. This combination of descriptive research and statistics was used to determine what relationships existed between the variables of technology integration, student engagement, and student achievement. Given this design, the study utilized an observation tool to collect data on observable levels of technology integration and levels of student engagement within middle school ELA and math classrooms. A Fisher's Exact cross-tabulation analysis was then applied to determine if significant relationships existed among levels of technology integration and levels of student engagement observed in those same classrooms. Then, levels of student achievement as measured by the state summative assessment were analyzed to determine if scores improved following 1:1 iPad technology integration.

Nationwide, school districts continue to invest in technology. These investments are often justified as providing and exposing students to the latest technological tools (Tyan-Wood, 2016). Unfortunately, without quantifiable research on the impact of the integration of these digital tools, it has been difficult to determine if the investment yielded any results in what matters most, i.e., student learning. Moving beyond surveys that determined teacher and student perceptions of how technology integration impacted learning, to quantifiable data measuring the effect on learning was critical (LEAD Commission, 2012).

Revisiting Stoner's (1999) LT integration cycle, the two constants in the model for effective implementation were student motivation considerations and evaluation of integration. Although student motivation was not a variable in the study, student engagement is closely linked to student motivation (Valentine, 2009). Therefore, the consideration of these two elements in the research and evaluation of the effectiveness of current learning technologies, such as 1:1 iPad initiatives in educational organizations, was still relevant (Stoner, 1999).

Target Population and Sampling Method

Within a large school district in the state of WV, there are 13 middle schools. In the spring of 2016, all 13 middle schools achieved less than 50% proficiency in meeting the achievement standard in math, as measured by WV's General Summative Assessment, the SBA. In the spring of 2016, 10 of the 13 middle schools achieved less than 50% proficiency in meeting the achievement standard in ELA as measured by the

SBA (ZoomWV, 2016). Since 2014, all 13 middle schools have become 1:1 schools affording every student and teacher iPads to enhance curriculum delivery and increase student engagement as per the Learning 20/20 initiative (S-ABC, 2016). Because of low achievement results, determining what levels of technology integration are present in these schools was designed to enlighten educators on its effects regarding both student engagement and achievement.

Procedures

The research was conducted in three middle school organizations within the same school district, identified as having 50% or greater of students not meeting achievement standards in both ELA and Math as measured by the SBA results from school year 2015–2016 (ZoomWV, 2016). The data collection process utilized an observation tool designed to measure student engagement and level of technology integration on a scale of 1–4. Observations of every ELA and math teachers' classes were conducted during the school day at each middle school. To ensure intra-rater reliability, all ELA and math teachers were observed by the same observer using the same observation tool during the spring semester of the 2016–2017 school year. Additionally, the observations of each middle school took place on different dates; however, all ELA and math teachers in the same middle school were observed during the same school day. The data collected using the IPI/SAMR model observation tools were then compared to the data results from the SBA results from the 2016–2017 school year.

Permission to observe the middle school organizations was granted by the school district's Assistant Superintendent for Middle Schools. To notify participants of the study, a letter stating permission to conduct the research at each middle school was sent to each building level principal. Each letter contained a subsequent notification statement to forward to the ELA and math teachers who were observed during the data collection process. The researcher scheduled the specific dates of data collection to take place at each school during the spring semester of 2017, with the building level principal of each middle school.

The purposeful sample that was chosen as the data source for the present study was comprised of three different middle school organizations demonstrating greater than 50% of students not meeting proficiency in both ELA and math. All three middle school organizations were located in three different areas within the school district. All three organizations had differing socio-economic and cultural demographics, and thus collectively represented the demographics and characteristics of the entire school district (S-ABC, 2016). The rationale behind the purposive cluster sampling of middle schools was rooted in the three schools combining to create a microcosm of the larger district. Additionally, the cluster sampling was also purposive as it targeted schools that were specifically identified as having greater than 50% of its student population not meeting achievement standards in both ELA and math as measured by the SBA (ZoomWV, 2016).

Therefore, in each of the three middle schools only ELA and math teachers were observed, which comprised the sample population. This sample included up to two ELA teachers and up to two math teachers from each grade level at each school. The total number of teachers observed within all schools was 27. Each ELA and math teacher was observed during one class period, and data was collected on student engagement and level of technology integration using the IPI/SAMR model observation tool.

Instrumentation

Data collection on both student engagement and level of technology integration was completed using an IPI/SAMR model observation tool. This tool combined a modified Valentine (2009) IPI scale with a Puentedura (2014) modified SAMR model scale. The rating scale for each category applied a range from 1 to 4. With this tool, each classroom observation yielded two numbers, one for level of student engagement observed ranging from 1 to 4 and one for level of technology integration observed ranging from 1 to 4. The rubric in Figure 4 details how the researcher rated each classroom observation in both level of student engagement and level of technology integration.

IPI (1, 2, 3, 4)		**SAMR (1, 2, 3, 4)**	
Level 1	Little to no engagement	***Level 1***	<u>*Substitution*</u>: Technology integration utilized by teacher and/or students replaces traditional tools, i.e., Smart-Board replacing chalkboard or digital tablet replacing paper
Level 2	Teacher led instruction with student involvement	***Level 2***	<u>*Augmentation*</u>: Technology integration utilized by teacher and/or students improves traditional tool to enhance instruction, i.e., word processing includes spell check
Level 3	Students engaged in active learning conversations and higher-order thinking	***Level 3***	<u>*Modification*</u>: Technology integration significantly modifies instructional delivery and/or student-generated work, i.e., developing a movie presentation with sound and video
Level 4	Students engaged in doing work involving higher-order thinking	***Level 4***	<u>*Redefinition*</u>: Technology integration redefines instructional delivery and/or student work, i.e, the curriculum delivery and/or product was previously not possible without the technological tool(s) utilized by teacher and/or student, e.g., creating an interactive iBook or collaborative mind-map.

Figure 4. Rubric for levels of student engagement and technology integration

Data Collection

The data was collected from two sources to conduct a cross-tabulation analysis analyzing whether higher levels of technology integration and student engagement equate to higher student achievement. The first data source was classroom observations using the IPI/SAMR model observation tool. Each ELA and math teacher from each school was coded using a configuration of the content area and grade level he or she taught at the time of the observations. For example, S-A: E6-A represented a sixth-grade ELA teacher (E6-A) from the first middle school observed (S-A). Teacher E6-A from S-A was observed on the same day as all other ELA and math teachers from S-A at each grade level. If a school had more than one ELA or math teacher assigned to the respective grade level, they were coded in alphabetical sequence. During each observation, the classroom instruction was given one rating (1–4) for level of student engagement and one rating (1–4) for level of technology integration observed. Once each classroom observation was completed, all data were placed into a password protected, Google sheets digital data collection spreadsheets/charts pictured in Appendix A, using a password protected iPad.

The second data source came from the 2016–2017 WV general summative assessment, SBA test scores. The SBA test data was disaggregated based on the ELA and math grade levels observed from each of the three middle schools where classroom observations were conducted. This data was collected and disaggregated using the data collection charts found in Appendix A.

Operationalization of Variables

The two primary variables measured in the present study were level of student engagement and level of technology integration observed in a classroom setting. These variables were measured with an observation tool that included both Valentine's (2009) IPI and Puentedura's (2014) SAMR model scales. The two variables of level of student engagement and level of technology integration were measured within ELA and math classrooms across three grade levels and three middle school organizations. Thus, level of technology integration and level of student engagement were the independent variables being analyzed within the research observations. The dependent variable was student achievement as measured by the WV general summative assessment, the SBA.

Regarding the two independent variables of technology integration and student engagement levels observed within middle school ELA and math classes, they were operationalized based upon a four-point scale. The optimum levels for student engagement were levels 3 and 4 as they encompass students discussing and engaging in higher-order thinking activities such as analyzing, synthesizing, and evaluating activities. The optimum levels for technology integration were also levels 3 and 4, defined as technology integration previously not possible that modifies and redefines curriculum delivery and student learning (Puentedura, 2014). These integration levels also included observing learning activities involving analyzing, synthesizing, evaluating, and creating.

In addition, the observer did not analyze the quality of instruction or evidence of instructional planning within the classroom. The observer did not evaluate the teacher during the classroom observation or choice of teacher pedagogy. The observer did not evaluate student behaviors or any element of classroom management during the classroom observations. The observer specifically focused on collecting data on the two variables of student engagement and technology integration.

Finally, the data collected on these two independent variables was then compared to the data produced from the final dependent variable of measure on student achievement, i.e., WV's general summative assessment, the SBA. The validity of this assessment has been analyzed since it was piloted in 2012. Specifically, the overall marginal reliability for ELA in grades six through eight ranges from 0.91 to 0.92, and from 0.91 to 0.93 for math. In addition, the Smarter Balanced Assessment conducts a yearly, comprehensive technical report analyzing the assessment for validity, errors of measurement, fairness, design, scores, scales, norms, administration, reading, and interpretation of the assessment (SBA, 2016).

Data Analysis

A Fisher's Exact cross-tabulation analysis was utilized to determine the frequencies at which technology integration and student engagement levels occurred in ELA and math classrooms. As a result, this research design provided a stronger, more quantifiable body of data to guide school leaders and educators in understanding how specific levels of technology integration impacted both student engagement and student achievement using the most accurate process for statistical comparison. The greater purpose, then, was to enhance both digital leadership and "transform schools in the digital age" to "prepare learners with essential digital age skills" proven through a statistically sound methodology (Sheninger, 2014, p. 4).

To analyze the data collected on the levels of student engagement using the IPI scale, the levels of technology integration using the SAMR model scale, and to what extent those data sources related to student achievement as measured by the SBA scale, descriptive statistics were utilized. After the data collection from classroom observations was completed at each of the three middle schools involved in the study, two cross-tabulation charts were generated. One reflected data on the frequencies at which IPI and SAMR levels occurred in all 14 ELA classrooms observed, and the other reflected data on the frequencies at which those same levels occurred in all 13 math classrooms observed.

These values were then analyzed by comparing the frequencies at which IPI and SAMR levels were observed in ELA and math classrooms across three middle schools housing grades six, seven, and eight. Following the cross-tabulation analysis, a review of all students' assessment scores occurred. This review encompassed comparing the assessment scores of over 1,000 students. This detailed analysis then generated data revealing the percentages of students' scores at each proficiency level of the SBA to be compared to the frequencies of levels of technology integration and student achievement observed in those students' ELA and math classrooms.

Limitations and Delimitations

Limitations that may have adversely affected the study included self-reporting and instrumentation. The utilization of only one observer, who determined the ratings of IPI and SAMR levels during each classroom observation created a limited perspective. However, one observer increased the consistency in which the observations were completed and decreased the possibility of human error in data collection. In addition, one rater or observer increased the validity of the observation tool (Kimberlin & Winterstein, 2008). Puentedura's (2014) SAMR model is a reasonably new barometer for measuring technology integration and is often utilized as a guide for instructional planning and reflection for teachers. The work of Romrell et al. (2014) proved it is a valid tool in evaluating personalized learning infused with technology, and in providing teachers with feedback on the impact of specific instructional technology strategies. Valentine's (2009) IPI scales have been tested for validity in numerous research studies beginning in the late 1990s. The tool has been proven valid in its accuracy of measuring student engagement as a part of school improvement programs beginning in Missouri and stretching across the east coast of the United States (Valentine, 2009).

Delimitations of the study included observing only three middle level educational organizations within one school district. These delimitations were rooted in accessibility and feasibility of the observer conducting the study within the time constraint of one semester of the school year. Additionally, because of the studied sample population restrictions, the results may not be generalizable beyond this specific programmatic level within this specific population.

Internal and External Validity

To reduce threats to the internal validity of the study, the research and data collection process utilized the same rater, the same instrument, and the same sequence of observations within each school. The observer followed the same observation schedule within each school, eliminating the variable of time of day or different daily operating schedule for the school. Specifically, if the observation of school A was conducted on Wednesday in which the school was following a regular bell schedule, all ELA and math teachers were observed on that same Wednesday where the school was following a regular bell schedule. The observer did not conduct data collection on irregular school days such as early dismissals, delay schedules, or assembly schedules. Because all schools involved in the observations were within the same school district, they all received the same amount of training regarding technology integration, the SAMR model, and IPI. All classrooms observed had a 1:1 tablet to student classroom environment. Therefore, members of the sample population had identical access to technology tools and training regarding the implementation of technology to increase student engagement and student achievement (S-ABC, 2016).

The exact dates that the observations would occur were not revealed to those being observed. As per the approval of the district superintendent for middle level programs, the principal notified the staff of the time frame in which the observations would take place, but not the specific day of the week or specific schedule of the observer. This eliminated the possibility that teachers or students might alter their behaviors due to an expected observation. Lastly, the selection of the sample population was a microcosm of the district population. The three schools combined to model the demographics of the district relating to gender, ethnicity, and socio-economic status so that the results were applicable and relevant to the entire district population.

Expected Findings

Technology and its tools such as computers and tablets are continually changing, modifying, and updating (Sheninger, 2014). Studies attempting to specify what works now and what might correlate to increased student engagement and even student achievement can add to the literature, thus benefitting educational leaders charged with using technology to increase both student engagement and student achievement. The present study expected to add to the literature advocating technology as a valid tool for improving both student engagement and student achievement, if the level of technology integration was relevant and meaningful. The more engaged that students become, the greater the opportunity for learning (Valentine, 2009). The higher the level of technology integration as measured by technology being utilized to do things never possible before in the classroom, the higher the level of student engagement (Puentedura, 2014). Therefore, the present study sought to determine the levels of technology integration most conducive to increasing student engagement and student learning, which both relate to increases in student achievement.

Specifically, it was expected that if a higher technology integration level was observed as rated by a Puentedura (2014) 3-Modification or a 4-Redefinition score, then the achievement level on the SBA as rated by a 3-Meets Proficiency or a 4-Exceeds Proficiency score would also be higher (ZoomWV, 2016). Puentedura (2014) defined the third level of his SAMR model, modification, as technology integration utilized to significantly redesign a task. Extending the level of technology integration to the fourth level of SAMR is then defined as redefinition, i.e., technology integration at a level allowing for the creation of tasks that have not been possible before (Puentedura, 2014).

For example, in facilitating students to create a presentation prior to technology integration, teachers may have required students to create a visual aid such as a poster or brochure using cardstock or some type of paper, pens, pencils, markers, and so on. A basic substitution or SAMR level 1 of the same task with technology integration is to allow students to utilize PowerPoint software, Prezi, or even Keynote applications to create an enhanced, digital presentation (Schrock, 2016). SAMR level 2, augmentation, is to facilitate students using the Show Me application to explain and analyze the understanding of presentation concepts (Schrock, 2016). SAMR level 3, modification, of the same task is to facilitate students creating a presentation combining audio, video, text, notes, and visuals into a digital iMovie, and an example of a SAMR level 4, redefinition, of the same task is a NearPod presentation created by students that can be designed collaboratively and shared digitally (Schrock, 2016). Thus, the SAMR level 4 of redefinition exposes students to higher-order thinking skills and processes as aligned with Bloom's taxonomy and higher student engagement conducive to increased student learning (Puentedura, 2016).

Consequently, the present study was designed to determine if students who are highly engaged and exposed to technology integration at higher levels as measured by the SAMR model demonstrated higher levels of student achievement as measured by the SBA. This assessment tool rates students in the content areas of ELA and math on four levels (WVDE, 2016):

1. Has not met the standard
2. Nearly met the standard
3. Met the standard
4. Exceeded the standard

In this rating system, students are given a holistic score on a scale of 1 to 4 and the term standard refers to the standard level of understanding for the specific grade level of the student for each assessed content area, i.e., ELA and math (WVDE, 2016). Thus, the present study determined that there were comparable frequencies between high levels of student engagement because of high levels of technology integration equating to higher levels of achievement on the SBA.

Ethical Issues

The present study sought to minimize any risks to the sample population and maximize knowledge to all educators and educational leaders for the benefit of students by determining the levels of technology integration yielding positive impacts of increased student engagement and achievement. To reduce any threats to the integrity of that aim, the observer had no financial, personal, or supervisory connection to those being observed. In addition, because all participants were informed of and consented to the classroom observations, the study was free of deception. The permission to observe teachers was verified via a letter of consent that the principal of each middle level educational organization received, read, and signed. The letter of consent detailed the purpose and process of the study (see Appendix B for letter of consent). Regarding bias, the observer was trained to recognize and rate technology integration as measured by the Puentedura (2014) SAMR model and the Valentine (2009) IPI scale. These trainings resulted in a strict adherence to the qualifications for an observation to be indicative of a high rating in either level of technology integration as measured by the SAMR model or level of student engagement as measured by the IPI scale.

Summary

Technology integration for learning has evolved to incorporate technological tools that have not been imagined before. The presence of this element within educational settings has led to paradigm shifts in approaches to teaching and learning (Sheninger, 2014). These shifts impact the core issues of quality teacher training, engaging digital learners, measuring technology integration, and digital leadership. Successful technology integration for learning incorporates what Couros (2015) defined as an innovator's mindset, and an ongoing focus of improving educational practices and academic achievement that aims to reduce the digital divide (Valiente, 2010). Most importantly, as Roth (2014) emphasized, technology integration in classrooms is no longer a choice because of technology being so prevalent in the jobs students seek to attain within a digitally proficient society. Educational leaders are charged with facilitating and monitoring technology integration for learning to ensure it has a positive effect on student achievement and is preparing all students for the 21st century world of employment (Sheninger, 2014).

An example of a 21st century classroom environment supporting technology integration for learning is a 1:1 setting utilizing touchscreen tablets. These technologies foster levels of technology integration in classrooms that redefine traditional classroom pedagogy, activities, and student-generated products. However, to what extent these newfound levels of technology integration impact both student engagement and achievement has yet to be determined. Therefore, the present study was designed to observe 1:1 classroom settings and collect data on observable levels of technology integration and observable levels of student engagement. Determining if the frequencies of specific levels of technology integration paralleled to more frequent increases in levels of student engagement and achievement provided the education community with pivotal knowledge in technology integration for increased student learning and achievement.

Chapter 4: Data Analysis and Results

Introduction

The purpose of the descriptive study was to compare the overall frequencies of student engagement and technology integration, and how those levels related to student achievement as measured by a state summative assessment. To make this determination, three middle schools were observed that were chosen because of their demographics. The student populations within these schools created a microcosm of the district. To align observations with those content areas that were assessed by the state summative assessment, i.e., the SBA, only ELA and math classrooms were observed from each of the three participating schools.

Following the observations, the data collected on levels of technology integration as measured by SAMR and student engagement levels as measured by IPI were compared using a cross-tabulation analysis. The results of this analysis generated overall frequencies of both technology integration and student achievement levels present during classroom observations that were then compared to student achievement results. The validity of the data collection tools was ensured by only one rater using identical data collection processes, and by all participants completing the same form of summative assessment, the SBA. In addition, all data collected in observations and in SBA results of participants were coded to remove school and student identities. Thus, this chapter provides a summary of the data collected in the ELA and math classroom observations for all three middle schools, a summary of the 2016–2017 SBA results in ELA and math for all three middle schools observed, an analysis of the study's data, and any limitations of the study regarding the study's sample population. Tables and charts demonstrate the data collected that assist in answering the study's research questions.

Research Questions

The questions that defined the descriptive research study were as follows:

Q1. To what extent, if any, is there a statistically significant relationship present between middle school students' levels of engagement and levels of technology integration during content area instruction of ELA and math classes, as measured by a SAMR model instructional practice inventory?

Q2. What is the relationship between middle school students' summative assessment performance, in the areas of ELA and math, and levels of technology integration during content instruction of ELA and math?

Research Hypotheses

H1a. There is a statistically significant relationship present between middle school students' levels of engagement and levels of technology integration during content area instruction of ELA and math classes, as measured by a SAMR model instructional practice inventory.

H1o. There is no statistically significant relationship present between middle school students' levels of engagement and levels of technology integration during content area instruction of ELA and math classes, as measured by a SAMR model instructional practice inventory.

Description of the Sample

The actual participant sample utilized did not differ compared to the sample described in the design of the study. The sample was comprised of three middle schools, all housing grades six through eight, from the same school district. Within each middle school observed, the sample was further narrowed down to teachers and students present in ELA and math classrooms. This translated to teacher participants ranging in ages from early 20s to late 60s, male and female, and from Caucasian, African-American, Hispanic, and/or bi-racial ethnicities. The total number of teachers observed from all three middle schools was 28. The student participants, male and female, ranged in ages from 10 to 15 years and were from Caucasian, African-American, Hispanic, Asian, and/or bi-racial ethnicities. The total number of students present during each individual classroom observation ranged from 15 to 25. The sample had a balance of male and female participants, but was mostly comprised of Caucasian teachers and students, with the second largest ethnicity represented being African-American. The student sample was also comprised of students from low socio-economic backgrounds. These demographics of the actual participant sample matched that of the proposed sample, generating a sample population indicative of the demographics of the total population of the entire school district where the study occurred. As a result, there were no modifications made to the actual participant sample compared to the proposed sample.

Research Methodology and Analysis

The descriptive study utilized a cross-tabulation design to determine how the frequencies of specific technology integration levels compared to levels of both student engagement and student achievement. This methodology further supported the study's intent to determine the significance of the varying levels of technology integration utilized in middle school ELA and math classrooms. During the ELA and math classroom observations, levels of student engagement and levels of technology integration were rated. The data collected from these observations was the first step in actualizing the purpose of the study, which was to quantitatively measure how effective specific levels of technology integration may or may not be comparable to increases in student engagement and/or student achievement.

The instruments utilized to collect data for the study are shown in Appendix A. The instruments were guided by the rubric for student engagement, drawn from Valentine's (2009) IPI scale indicators, as well as Puentedura's (2014) SAMR model indicators, which both rate observations in each area on a four-point scale. The instruments demonstrated outstanding suitability for the data collection process and added to the efficiency of the data analysis process.

These data results were then disaggregated by each middle school observed, and subsequently disaggregated by both grade level and content area of ELA and math. As anticipated, the number of students at each grade level and in each content area of ELA and math achieving an assessment score of 1 (below standard), the number of students achieving an assessment score of 2 (at or near the standard), the number of students scoring 3 (meeting the standard), and the number of students scoring 4 (exceeding the standard) were placed into the data charts located in Appendix A. The data from both the observations and the assessment results were then analyzed using cross-tabulation to compare levels of technology integration to both student engagement and achievement.

Results of Statistical Analysis

Research Q1. To what extent, if any, is there a statistically significant relationship present between middle school students' levels of engagement and levels of technology integration during content area instruction of ELA and math classes, as measured by a SAMR model instructional practice inventory?

The question as to whether there would be a comparable relationship between levels of student engagement and levels of technology integration or not was tested via classroom observations. The data collected are shown in Table 1, Table 2, and Table 3, which include the specific ratings of IPI and SAMR collected during the classroom observation process.

Tables 1, 2, and 3 illustrate the data collected via observations from each of the three middle schools comprising the total population involved in the study. Additionally, the data was configured by rating the level of IPI and SAMR observed during the same classroom observation of the specific content area (ELA or math) and grade level (6, 7, or 8). Both student engagement (IPI) and level of technology integration (SAMR) observed were rated on a four-point scale, with 1 equating to the lowest possible rating and 4 being the highest possible rating.

Table 1

IPI and SAMR (S-A)

S-A			
Subject	Grade Level	IPI	SAMR
ELA	6	2	4
ELA	6	4	4
ELA	7	4	3
ELA	7	4	3
ELA	8	4	4
Math	6	2	2
Math	6	3	3
Math	7	3	4
Math	8	4	4

Table 2

IPI and SAMR (S-B)

S-B

Subject	Grade Level	IPI	SAMR
ELA	6	2	3
ELA	7	3	1
ELA	8	2	1
Math	6	2	1
Math	7	4	3
Math	8	3	2

Table 3

IPI and SAMR (S-C)

S-C

Subject	Grade Level	IPI	SAMR
ELA	6	4	3
ELA	6	4	4
ELA	7	3	3
ELA	7	3	2
ELA	8	4	1
ELA	8	3	2
Math	6	3	1
Math	6	2	1
Math	7	4	4
Math	7	3	3
Math	8	3	1
Math	8	3	2

Using the data in Tables 1, 2, and 3, descriptive statistics were run to generate the following cross-tabulation data sets. The following data table, Table 4, reflects the frequencies of both IPI levels and SAMR levels for all grade levels in ELA.

Table 4

IPI and SAMR frequencies in ELA for all grade levels

ELA Classrooms	Level 1	Level 2	Level 3	Level 4	Total
IPI	0	3	4	7	14
SAMR	3	2	5	4	14
Total	3	5	9	11	28

Note. Fisher's exact test yields $P_A = 0.16$ and $P_B = 0.16$, $p > .05$ there is no evidence of a statistically significant relationship

The following data table, Table 5, reflects the frequencies of both IPI levels and SAMR levels for all grade levels in math.

Table 5

IPI and SAMR frequencies in math for all grade levels

ELA Classrooms	Level 1	Level 2	Level 3	Level 4	Total
IPI	0	3	7	3	13
SAMR	4	3	3	3	13
Total	4	6	10	6	26

Note. Fisher's exact test yields $P_A = 0.16$ and $P_B = 0.16$, $p > .05$ there is no evidence of a statistically significant relationship

By analyzing the data from Tables 1, 2, and 3 that is disaggregated in Tables 4 and 5, comparisons could be made in relation to the frequencies of technology integration levels (SAMR) and student engagement levels (IPI). Specifically, after analyzing the data illustrated in Table 4 with Fisher's Exact cross-tabulation, the *p*-values for comparing the frequencies between IPI and SAMR in ELA classroom observations were 0.34 and 0.29. Because $p > 0.05$, the null hypothesis H1o cannot be rejected. There is no evidence of a statistically significant relationship between levels of technology integration and levels of student engagement observed in middle school ELA classrooms as $P_A = 0.34$ and $P_B = 0.29$.

In math, after analyzing the data illustrated in Table 5 with Fisher's Exact cross-tabulation, the p-values for comparing the frequencies between IPI and SAMR were both 0.16. Once again, because $p > 0.05$, the null hypothesis H1o cannot be rejected. Again, there is no evidence of a statistical significant relationship between levels of technology integration and levels of student engagement observed in middle school math classrooms as $P_A = 0.16$ and $P_B = 0.16$.

In addition to determining whether there was a statistically significant relationship between level of technology integration and level of student engagement in the classroom observations, the highest number of occurrences of any student engagement level was in ELA with an IPI level of 4. This equated to 50% of the frequencies observed for student engagement levels. The highest number of occurrences or most frequently observed level of the SAMR model was a level 3, which equated to 35.7%. These higher levels of both student engagement and technology integration that were more readily observed, and therefore occurred more often, in ELA courses could have positive effects on student achievement. The work of both Puentedura (2014) and Valentine (2009) stressed that higher levels in SAMR and IPI translate to students completing tasks that modify and redefine what students accomplish in class, which includes higher-order thinking.

In the content area of math, however, the frequencies were not as comparable.

There was not one level of technology integration that occurred more frequently than another, meaning the levels of technology integration were very inconsistent in the content area of math. This is translated to a range of 20–30% of students using technology at varied levels as measured by SAMR. In contrast, one level of student engagement occurred twice as frequently as the other levels in math classroom observations. Over 50% of the 13 math classroom observations had an IPI level of 3 compared to 23.1% at level 2 and 23.1% at level 4. An IPI level of 3 is considered to include students being engaged in higher-order thinking skills and activities; however, in these same classrooms there was not a frequent occurrence of high levels of technology integration as measured by SAMR.

Research Q2. What is the relationship between middle school students' summative assessment performance, in the areas of ELA and math, and levels of technology integration during content instruction of ELA and math?

The data collected from the summative assessment scores are shown in Table 6, Table 7, and Table 8 in Appendix C. Each table represents the data collected by the 2016–2017 SBA summative test results in the subject areas of ELA and math at each grade level from each of the three middle schools comprising the total population involved in the study. The achievement on the assessment was measured by a four-point scale: a score of 1 equaling below standard, 2 equaling at or near the standard, 3 equaling meeting of the standard, and 4 equaling exceeding the standard. The data reflected in the tables were configured by totaling the number of students who scored at each level in each content area (ELA and math) and in each grade level (6, 7, and 8) from each of the three middle schools observed. Scores equaling 1 are classified as below the standard or novice, scores equaling 2 are classified as near the standard, scores equaling 3 are classified as having met the standard or mastery, and scores equaling 4 are classified as exceeding the standard or above mastery in the content area assessed. If a student has a score equaling 3 or higher, he or she is considered grade-level proficient in the content area of study assessed (WVDE, 2016).

As reflected in Table 6 referenced in Appendix C, S-A had many students scoring at a level 3 or less on the assessment. Few students scored as exceeding the standard with a score of 4 in either content area of ELA or math. Specifically, in ELA, 44% of students scored at a level 1, 26% of students scored at a level 2, 24% at a level 3, and only 6% of students in S-A scored at a level 4 in ELA. Similarly, in math 48% of students scored a level 1, 27% a level 2, 18% a level 3, and only 7% of students earned a score of 4.

The SBA results from S-B shown in Table 7, referenced in Appendix C, bode higher achievement in ELA compared to S-A, but lower achievement results in math. In ELA, 43% of students achieved a score of 1, 27% of students achieved a score of 2, 22% scored at a level 3, and 8% earned a score of 4. In math, however, scores were lower with nearly half of the student population, 48%, scoring at a level 1, 32% scoring at a level 2, 13% scoring a level 3, and only 7% scoring a level 4 on the SBA.

In analyzing the data reflected in Table 8, referenced in Appendix C, from the final middle school, S-C, the assessment results of the largest of the three schools were the lowest in terms of achieving proficiency in either ELA or math as measured by the SBA. In ELA, 45% of students achieved a score of 1, 25% scored a level 2, 22% achieved a level 3, and 8% scored at a level 4. In math, the scores were even lower with over half, 52%, of the total student population of S-C scoring at a level 1. Another third of students, 27%, scored a level 2, while 17% of students scored a level 3, and only 4% scored at a level 4. These 2017 SBA achievement scores from each of the three middle schools are similar in demonstrating more than 50% of students still struggle to achieve mastery in the content areas of ELA and math, as measured by the SBA. The parallels in the scores from school to school is also evidence the schools observed may differ slightly in demographics; however, they share the struggles of meeting mastery in achievement as measured by state issued summative assessments.

To determine whether any relationship existed between the levels of technology integration observed as measured by SAMR and the levels of achievement as measured by the SBA, Tables 9, 10, and 11 contain data of the average ratings of SAMR and SBA in ELA and math for each middle school. The SAMR averages were calculated by computing the total number of SAMR levels in ELA and math observed at the middle school observed and dividing by the total number of observations taken for each content area. The SBA averages were calculated by taking the total number of student scores for the specific middle school observed and dividing by the total number of students who were tested.

Table 9

SAMR and SBA Average Scores (S-A)

S-A		
Subject	SAMR (1–4)	SBA (1–4)
ELA	3.6	1.5
Math	3.25	1.5

Of the three middle schools observed, S-A had the highest average level of technology integration at 3.6 for ELA and 3.25 for math. The school demonstrated the most consistency in the level of technology integration observed from classroom to classroom as measured by the SAMR model rating on a scale of 1–4. Despite these high levels of technology integration, the school's average summative assessment scores were still well below mastery at an average of 1.5 in both ELA and math as measured by the SBA.

Table 10

SAMR and SBA Average Scores (S-B)

S-B		
Subject	SAMR (1–4)	SBA (1–4)
ELA	1.67	1.5
Math	2	1.5

Table 10 illustrates the data from S-B, which had the lowest of the three averages in levels of technology integration observed in ELA and math. These low scores paralleled the low scores on the summative assessment. Both SAMR ratings and SBA achievement scores were less than 2 on the rating scales of 1–4, demonstrating low levels of technology integration and low levels of achievement in both content areas of ELA and math.

Table 11

SAMR and SBA Average Scores (S-C)

S-C		
Subject	SAMR (1–4)	SBA (1–4)
ELA	2.5	1.5
Math	2	1

Table 11 reflects the data of S-C in the averages of SAMR and SBA. With levels of technology integration being very inconsistent throughout the observations of ELA and math classrooms, the average level for the school was a 2 for math and slightly greater than that for ELA at 2.5. Despite the levels of technology integration being above 1, the levels of achievement on the SBA in both ELA and math were below 2 with an average achievement score of 1.5 for ELA and an average score of 1 for math.

After comparing average SAMR ratings for levels of technology integration present in classrooms to the summative assessment scores of students within those classrooms observed, there was no significant relationship between the two. This indicates little to no relationship between the average level of technology observed in middle schools as measured by SAMR and the average level of achievement in ELA or math as measured by SBA.

Summary of Results

Fortunately, the data collection process did not require any alternative steps to heighten validity and reliability of the results designed to answer the research questions.

This was due to the data collection process adhering to the scheduled observation plan within each participating school and no unforeseen interruptions occurred. In addition, the data collection process and subsequent data results did not pose any threats to internal validity, no unforeseen limitations were encountered, and no changes to the original delimitations were necessary. Further, the appropriateness of the statistical analysis of the data did not deviate from the proposed analysis and was not modified in any fashion.

The data collection process did not deviate from the proposed process, although the data results did not align with anticipated results. There was a not statistically significant relationship between the level of technology integration as measured by SAMR and level of student engagement as measured by IPI in ELA and math classrooms observed in middle school grades six, seven, and eight. In addition, given that comparable frequencies were found, the data analysis suggests the level of technology integration present in ELA and math classes does impact on the level of student engagement. This suggests if a higher level of SAMR were to occur more frequently, then the level of student engagement would also be a more frequent occurrence.

Finally, regarding the level of technology integration as measured by SAMR and student achievement, the data results above suggested there is little to no relationship or valid comparison. Specifically, there was no relationship found between level of technology integration observed and performance level of student achievement on the SBA in any of the three middle schools observed. In both ELA and math, more instances of higher levels of technology integration observed in middle school classrooms did not to equate to higher levels of student achievement as measured by SBA. Thus, although the higher level of technology integration observed as measured by SAMR was comparable to higher levels in student engagement, it was not comparable to higher levels of achievement as measured by the SBA.

Chapter 5: Discussions and Conclusions

Introduction

As the use of technological tools in classrooms increase, so does the need to measure their effectiveness. In the present study of how specific 1:1 tablet technology impacted on middle school students in the areas of engagement and achievement in ELA and math, the results add to the body of knowledge guiding educators in effective technology integration. Specifically, quantifying the effects of higher levels of technology integration with respect to student engagement and student achievement solidifies the importance of how best to incorporate 1:1 tablet technology within middle level classrooms. The following chapter will summarize the results of the study, connect the results to the relevant literature, and make recommendations for further research guided by these findings. In addition, limitations of the study and what the conclusions imply for the practice, policy, and theory of technology integration in education will be addressed. The conclusions and discussion thereof found within this final chapter serve to inform and inspire future studies in technology integration for improved student engagement and achievement.

Summary of Results

In addressing the first research question designed to determine to what extent a statistically significant relationship exists between levels of technology integration as measured by SAMR (Puentedura, 2014) and levels of student engagement as measured by IPI (Valentine, 2009), the results met expectations. In 14 ELA classrooms, the rate at which high levels of IPI occurred and the rate at which high levels of SAMR occurred paralleled one another. This demonstrates a comparable relationship between level of technology integration utilized in ELA classrooms for grades six, seven, and eight, and level of student engagement. Moreover, because $P_A = 0.34$ and $P_B = 0.29$ meaning $p > 0.05$, the null hypothesis H1o could not be rejected as there was not a statistically significant relationship between SAMR levels and IPI levels in ELA classroom observations. The observation data for the 13 math classrooms from the same middle schools did not reflect the same comparisons. There were no similarities in the frequencies at which technology integration levels were observed and the frequencies at which student engagement levels were observed. Therefore, the cross-tabulation data results for the content areas of ELA and math from the same schools and grade levels differed. Despite this difference, because $p > 0.05$, the null hypothesis H1o could not be rejected for observed math classrooms. There was no evidence of a statistically significant relationship between levels of technology integration and levels of student engagement observed in middle school math classrooms as $P_A = 0.16$ and $P_B = 0.16$.

Regarding the second research question guiding the present study, the results were disappointing. Specifically, after a careful analysis of summative assessment results, the level of technology integration as measured by SAMR did not correlate to higher levels of achievement as measured by the SBA in ELA or math for grades sixth, seventh, and eighth. Unfortunately, all three middle schools had similar results in both ELA and math achievement as measured by the four-point scale of the SBA. This scale equates a student's score of a level 1 or 2 on the assessment as below standard of the content area being assessed, a student's score of a level 3 as having met the standard of the content area being assessed, and a student's score of a level 4 as being above the standard of the content area being assessed. In all three middle schools comprising the sample population, 43–45% of students scored a level 1, the lowest level of achievement in ELA and/or math. A range of 25–27% of students scored a level 2, classified as at or near the standard, in the two content areas assessed. A total of 22–24% of students scored a level 3 equating to meeting the standard in the content areas assessed, and only 6–8% of students scored a level 4 of exceeding the standard in ELA and/or math. This clearly reveals no relationship between these two variables, proving that the level of technology integration observed in ELA and math classrooms within the three middle schools as measured by SAMR was not comparable to a higher level of student achievement in ELA or math as measured by the SBA.

Discussion of the Results

The summary of the results proved that higher levels of technology integration can yield higher levels of student engagement, especially in ELA and math classrooms for middle grades sixth, seventh, and eighth. However, the results also evidenced no parallels between higher levels of technology integration and higher student achievement. Within Tables 1, 2, and 3, there are patterns of higher student engagement as measured by IPI, when higher levels of SAMR are present in the classroom. These patterns support the use of technology integration in both ELA and math classrooms as a valid tool for increasing student engagement. In addition, the relationship between SAMR and IPI levels supports the importance of incorporating higher levels of technology integration in the classroom as measured by SAMR. Therefore, teachers moving beyond the substitutive and applicatory levels of utilizing technology for the sake of technology is essential (Sheninger, 2014).

Thus, when technology reaches SAMR levels of 3 and 4, defined as modification and redefinition, students are likely to be more engaged in activity that modifies or redefines the task in connection to the content area being taught (Puentedura, 2014). Moreover, if higher levels of student engagement, measured at a 3 or 4 on the IPI scale, are achieved in correlation to higher levels of technology integration, then students are utilizing higher-order thinking skills and practices in connection to those content areas of ELA and math (Valentine, 2009). These results are likely related to students finding relevance in utilizing the modern technological tools of their everyday lives to connect to the learning goals, objectives, and standards taught in classrooms today (Tyan-Wood, 2016).

Although the results of the present study proved that a higher level of technology integration was observed at a similar rate as a higher level of student engagement, the secondary purpose of the study did not reveal positive results. In fact, there was no significant relationship between the level of technology integration and level of student achievement observed in ELA and math classrooms among the three middle schools comprising the sample population of the study. Tables 9, 10, and 11 illustrate that the data utilized to determine technology integration levels as measured by the four-point SAMR model scale versus the achievement level of students as measured by the four-point scale of the SBA had no observable relationship. This means no significant relationship was determined for a higher level of technology integration equating to a higher level of student achievement in ELA or math at the middle school level.

Two factors influencing the outcome of the study may have been its specificity and the summative assessment taken by students comprising the sample population. To successfully integrate technology for effective learning and increased student achievement, identifying the desired learning outcomes or goals should preclude the selection of technology (Bryant, 2016). The present study analyzed the specific use of 1:1 tablet technology in middle school settings, and only targeted ELA and math classrooms to align with the SBA for those two content areas. Despite these specific parameters of the study, the SBA is a very comprehensive test covering many ELA and math standards for grades six, seven, and eight (WVDE, 2016). There may have been a stronger relationship found between technology integration and student achievement if the scope of the assessment was not as broad, and was better aligned to the specific learning standards targeted when the specific levels of technology integration were present during classroom instruction. In addition, the three middle schools comprising the sample population utilized in the study mirrored the demographics of the district. The middle schools within the same district who traditionally yield the highest assessment results were not included in the study, so as not to skew the data in terms of inflated achievement results. However, if these schools had high levels of technology integration present and high achievement data, a statistically significant relationship between technology integration and high student achievement among high performing students may have been observed.

An unforeseen factor possibly impacting the variable of student achievement was how seriously students applied themselves to the summative assessment, i.e., the SBA. The reason this uncontrollable variable is valid is due to it being the final year the assessment will be utilized by the state department to evaluate schools in terms of academic achievement and accountability, and the new accountability system yet to be declared by the state department of education will not include SBA results (WVDE, 2017). Following the observation research of the present study, and prior to the completion of the assessment data of the study, the WV board of education voted to waive the current accountability system (WVDE, 2017). This vote came following a new state governor elect changing the dynamics of the WVBE and very shortly after a change in state level school superintendent. Therefore, this new knowledge of the assessment not counting in terms of school performance may have indirectly led to students choosing not to put forth their best efforts to demonstrate their knowledge.

Discussion of the Results in Relation to the Literature

The results of the present study speak to the community of practice, literature, and community scholars around educational leadership for the digital age. Finding the right balance between increasing student achievement amidst making curriculum delivery relevant to students using 21st century technological tools is essential for preparing students for success in 21st century world of employment (Tyan-Wood, 2016). The problem central to this issue is what the present study hinged upon. When a strong majority of students are not meeting mastery in the core content areas of ELA and math, and a 1:1 tablet technology initiative is designed to shift students into higher achievement results, determining the measure of its success is critical to the community of practice. Although there was no evidence of a significant relationship between technology integration levels and student achievement levels within the scope of the present study, the relationship between levels of technology integration and levels of student engagement is something to build upon.

Stoner’s (1999) life cycle for LT integration referenced the importance of strong implementation, teacher training, student motivation considerations, and continuous monitoring of technology integration. To analyze the components of student motivation considerations and to measure the effectiveness of the 1:1 technology on student performance, the results of the present study are connected to the literature and community of scholars. It was discovered that increased levels of technology integration increased student engagement. This finding supports the studies by Valentine (2009), Heaton (2013), and Sheninger (2014) who favored technology integration for meaningful student engagement. However, this finding contradicts the studies by Tyan-Wood (2016), Murphy (2014), and Spencer (2012) who all claimed tablet technologies distractions outweigh the dividends gained by increased student engagement. Similarly, what was found in the research by Carr (2012) and Lopuch (2013) in their respective tablet technology studies is the need for refined ways to measure the impact they have on student achievement. Despite the increased levels of technology and subsequent increased levels of student engagement found in the present study, because these results did not equate to increased student achievement as measured by a comprehensive summative assessment, it further encourages the community of practice to determine ways to better measure the impact of 1:1 tablet technology integration within middle schools.

In addition, the gap in research that fueled the design of the present study remains to be closed in a concrete fashion. The work of Heaton (2013) emphasized a lack of quantitative data demonstrating how specific technologies increase student achievement compared to that of research on student and teacher perceptions on the impact of classroom technology integration in general terms. The present study involved a researcher going into classrooms to observe and measure levels of technology integration with a research-based model. The results of this methodology revealed a positive relationship between observable levels of technology integration and student achievement. Although the results did not reveal levels of technology integration increasing student achievement on assessment results, the study design incorporated a quantitative data collection process and an approach that involved direct observation of classroom technology integration.

Limitations

Fortunately, the present study did not encounter vast limitations. The study was conducted as designed with little to no major changes in procedures or protocols. However, after post-analysis of the design of the study, if it were to be replicated the sampling, period of study, and variables could be improved upon. The present study chose three middle schools to observe as the sample population. Although the demographics of the three middle schools served as a microcosm for the district, it was a small sampling population. The results may have been altered if the sample population included a greater number of middle schools or even middle schools outside the school district who also incorporated 1:1 tablet technology.

Second, and related to the limitation of a small sample population, was the time constraint of conducting the classroom observations. It was essential to the study to complete all classroom observations prior to students taking the summative assessment, with all observations conducted within a month of students taking the summative assessment. Stronger comparisons between levels of technology integration and student engagement, and between levels of technology integration and student achievement, may have been observed if observations had taken place from the beginning of the school year until just prior to students taking the summative assessment.

A final limitation of the study is the variable of the assessment utilized to measure student achievement, i.e., the SBA. This assessment was comprehensive and covered many learning standards in both ELA and math to determine student achievement levels. An assessment targeting only standards taught using specific levels of technology integration could yield different results. Furthermore, the SBA is now obsolete as it will no longer be utilized by the school district or state where the observations of the schools comprising the sample population occurred. As a result, the study cannot be replicated using the same summative assessment measure in the future.

Implication of the Results for Practice, Policy, and Theory

The present study expected to add to the advocacy for technology as a valid tool that is utilized to improve both student engagement and student achievement, if the level of technology integration was relevant and meaningful. The more engaged students become, the greater the opportunity for learning (Valentine, 2009). The higher the level of technology integration as measured by technology being utilized to do things that have not been possible before in the classroom, the higher the level of student engagement (Puentedura, 2014). Therefore, the present study sought to determine the levels of technology integration that was most conducive to increasing student engagement and student learning, which both correlate to increases in student achievement. Higher levels of technology integration did increase student engagement; however, the same observation was not found in technology integration relating to higher student achievement results. The outcomes of the present study support theory validating the use of technology integration for positive impacts in classrooms and the results also challenge the theory and practice of technology integration increasing student achievement.

In addition, the results did produce data-driven evidence for teachers, educational leaders, and technology integration specialists as to what extent levels of technology integration impact student engagement and student achievement. Therefore, the greater purpose was to enhance both digital leadership and “transform schools in the digital age” to “prepare learners with essential digital age skills” proven through a statistically sound methodology (Sheninger, 2014, p. 4). From analyzing the results, the primary and secondary purposes have been achieved. Increased technology integration levels in 1:1 tablet technology paralleled with increased levels of student engagement. This reaffirms the direction that education must continue to take to prepare students for the 21st century world of employment with the very work tools they will utilize. This also confirms the need to continue meaningful and relevant professional development for educators in the arena of increasing technology integration that promotes higher-order thinking and application at all programmatic levels as measured by the SAMR model (Puentedura, 2014).

Finally, revisiting the conceptual framework for the present study, Stoner’s (1999) LT life cycle hinged upon constant evaluation of implementation. In reviewing the pillars of that life cycle in the context of the present study, i.e., quality teacher training, engaging digital learners, measuring technology integration, and digital leadership, these were all validated by the results. The quality teacher training to carry out a 1:1 tablet technology initiative made it possible to better engage digital learners in the classroom setting. Further, as measured by the SAMR and IPI rubrics, quantitative data was generated supporting higher technology integration levels increasing student engagement. Thus, as Fullan (2014) reminded educational leaders, digital leadership requires learning along with those you lead as an active learner. Just as technology advances at a rapid pace, the learning in leadership must continue. Valiente (2010) called for the need to continue to reduce the digital divide between the social uses of technology and the educational practices utilizing technology for the sake of student achievement. The present study further validates that call, that need, and results indicate more work is required to quantify meaningful ways to facilitate technology usage for increased learning and student achievement (Theis, 2016).

Recommendations for Further Research

According to a 2013 study, teachers are linking educational technology to more benefit than harm (Frey, 2016). Specifically, nearly 75% of teachers are now claiming technology is a gateway to reinforcing content, motivating students to learn, responding to more learning styles, and doing things they never thought possible for their students (Frey, 2016). This shift in what Couros (2015) referenced as mindset is critical to further research in technology integration. The results of the present study also indicate the need for more research to be undertaken to produce quantifiable data proving which levels of technology integration maximize student learning and achievement. To strengthen and add to the results of the present study, it could be replicated over a longer period, across multiple school districts, expanded across more grade levels, encompass more content areas of study, and the type of assessment utilized altered to measure student achievement. If the study were to be replicated over a longer period, stronger similarities between levels of technology integration and student engagement may or may not have occurred, but the validity of such comparisons would have increased owing to a study containing more observations. Expanding the study across more school districts and comparing those results to the results of the present study would strengthen and add to the existing data.

In addition, if the sample size was increased to include more schools, more observations, and more assessment data, a strong case for utilizing additional correlational data analysis could be made. This type of data analysis would consequently produce more quantitative research to understand the relationships between meaningful technology integration, student engagement, and student achievement. New conclusions could also be drawn comparing different demographics or even different technologies such as 1:1 tablet technology integration versus laptop technologies. Similarly, expanding the study to primary and high school levels of education would add to the body of knowledge and data produced by the present study. Lastly, better aligning the assessment of student achievement with specific learning goals and objectives that the technology integration was designed to support might produce additional knowledge regarding what specific levels of technology integration increase student achievement.

Conclusions

In the words of Roth (2014), “Integrating technology is no longer a choice. It has become too prevalent in the jobs students are being prepared to seek in the 21st century workplace” (p. 3). According to Tyan-Wood (2016), “In the last 20 years, we have built a massive body of knowledge and incredible tools to allow anyone to access it from anywhere at any time. It has transformed every industry. Shouldn’t we harness it to raise the smartest, most inquisitive, creative, and educated population in history?" (p. 6). Attempting to encourage and add to the body of knowledge in the innovative arena of technology integration for increased student engagement and achievement, the present study sought to answer two research questions. The first question addressed determining to what extent a statistically significant relationship existed between higher technology integration levels and student engagement levels. A parallel in the occurrences of those two variables as measured by IPI and SAMR was observed in both ELA and math. The second question addressed analyzing the relationship between levels of technology integration and student achievement. The data results determined there was little to no comparable relationship between the variables of technology integration and student achievement.

Given these results, the significance lies in the need for further research. Because of the incredibly fast pace at which technology integration evolves, there is a continual need for studies to be designed to guide scholars in determining how it can be better harnessed to make a positive impact in education. The unique experience of observing classrooms using the latest tablet technology in a 1:1 setting to measure its impact can and should be continued. It is hoped that the present study will inspire a replication and expansion of this research. In doing so, may it better chart the uncharted and ever-changing waters of integrating technology, for the sake of enabling students to set sail into 21st century success.

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Appendix A: Data Collection Charts

Middle School A (S-A)					
Teacher (ELA)	*IPI (1,2,3,4)*	*SAMR (1,2,3,4)*	*Teacher (Math)*	*IPI (1,2,3,4)*	*SAMR (1,2,3,4)*
	OBS (1)	*OBS (1)*		*OBS (1)*	*OBS (1)*
E6-A			M6-A		
E6-B			M6-B		
E7-A			M7-A		
E7-B			M7-B		
E8-A			M8-A		
E8-B			M8-B		
E8-A			M8-A		

Middle School B (S-B)					
Teacher (ELA)	*IPI (1,2,3,4)*	*SAMR (1,2,3,4)*	*Teacher (Math)*	*IPI (1,2,3,4)*	*SAMR (1,2,3,4)*
	OBS (1)	*OBS (1)*		*OBS (1)*	*OBS (1)*
E6-A			M6-A		
E7-A			M7-A		
E-8A			M8-A		

Middle School C (S-C)					
Teacher (ELA)	*IPI (1,2,3,4)*	*SAMR (1,2,3,4)*	*Teacher (Math)*	*IPI (1,2,3,4)*	*SAMR (1,2,3,4)*
	OBS (1)	*OBS (1)*		*OBS (1)*	*OBS (1)*
E6-A			M6-A		
E6-B			M6-B		
E7-A			M7-A		
E7-B			M7-B		
E8-A			M8-A		
E8-B			M8-B		

Middle School A (S-A)									
(ELA)	***SBA ELA Proficiency***				*(Math)*	***SBA Math Proficiency***			
	Students scoring at level:					***Students scoring at level:***			
	1	***2***	***3***	***4***		***1***	***2***	***3***	***4***
E6					M6				
E7					M7				
E8					M8				

Middle School B (S-B)									
(ELA)	***SBA ELA Proficiency***				*(Math)*	***SBA Math Proficiency***			
	Students scoring at level:					***Students scoring at level:***			
	1	***2***	***3***	***4***		***1***	***2***	***3***	***4***
E6					M6				
E7					M7				
E8					M8				

Middle School C (S-C)									
(ELA)	***SBA ELA Proficiency***				*(Math)*	***SBA Math Proficiency***			
	Students scoring at level:					***Students scoring at level:***			
	1	***2***	***3***	***4***		***1***	***2***	***3***	***4***
E6					M6				
E7					M7				
E8					M8				

Appendix B: Letter of Consent

Dear Principal,

I am writing to garner consent to observe classrooms in your building as part of a quantitative research study. The purpose of the study is to determine what levels of technology integration correlate to higher levels of student engagement and student achievement. The process of the study would require myself to observe all English language arts (ELA) and math classrooms and rate the level of technology integration and level of student engagement present in each classroom. The level of technology integration will be rated using the SAMR model and the level of student engagement will be rated using the IPI inventory model, two rating systems our district's teachers have been fully trained to understand. The observations will not evaluate the teacher in any way. The observations will only rate the level of student engagement observed, and the level of technology integration observed. All data collected will be coded by classroom, maintaining confidentiality and no identification of the specific school observed or teacher observed.

Upon your approval, the two observations would take place in the same semester of the school year. To maintain the integrity of the study, I respectfully request to observe on two separate school days in which the daily schedule is uninterrupted and follows a regular bell schedule. Each observation will take place on the same day of the week, but in two different weeks within the same semester of the same school year. Following your consent to conduct the observations of your ELA and math classrooms, we will determine the specific dates when they will take place.

In closing, I thank you for your time and consideration regarding this request to conduct observations within your school and its ELA and math classrooms. The observations and data collected would serve to support a quantitative study designed to add to the body of research regarding determining to what extent higher levels of technology integration correlates to higher levels of student engagement and student achievement.

Sincerely,

Jaclyn M. Swayne
Doctoral Candidate
Concordia University

Appendix C: 2017 SBA Scores

Table 6

SBA Results in ELA and Math (S-A)

S-A					
Subject	Grade Level	Scores =1	Scores =2	Scores =3	Scores =4
ELA	6	65	34	33	6
ELA	7	50	34	29	9
ELA	8	52	30	28	6
Math	6	55	38	34	11
Math	7	61	37	17	7
Math	8	66	25	17	8

Table 7

SBA Results in ELA and Math (S-B)

S-B					
Subject	Grade Level	Scores =1	Scores =2	Scores =3	Scores =4
ELA	6	43	28	32	10
ELA	7	59	36	32	6
ELA	8	52	33	16	11
Math	6	37	48	16	13
Math	7	73	38	18	6
Math	8	67	30	12	6

Table 8

SBA Results in ELA and Math (S-C)

S-C					
Subject	Grade Level	Scores =1	Scores =2	Scores =3	Scores =4
ELA	6	62	38	19	14
ELA	7	61	34	37	8
ELA	8	62	33	35	10
Math	6	74	36	13	7
Math	7	67	49	17	8
Math	8	99	27	11	3

Appendix D: Statement of Original Work

I attest that:

1. I have read, understood, and complied with all aspects of the Concordia University-

   Portland Academic Integrity Policy during the development and writing of this

   dissertation.

2. Where information and/or materials from outside sources has been used in the

   production of this dissertation, all information and/or materials from outside sources has been properly referenced and all permissions required for use of the information and/or materials have been obtained, in accordance with research standards outlined in the *Publication Manual of The American Psychological Association*

_____Jaclyn M. Swayne_______________________________________

Digital Signature

_____Jaclyn M. Swayne____

Name (Typed)

_____9/27/2017____

Date