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A Review of Technology and Its Impact on Middle School Classrooms

Curtis Alan Gustafson
Bethel University

A REVIEW OF TECHNOLOGY AND ITS IMPACT ON MIDDLE SCHOOL CLASSROOMS

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CURTIS GUSTAFSON

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Curtis Gustafson

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Thesis Advisor: Lisa M. Silmser, Ed. D.

Program Director: Lisa M. Silmser, Ed. D.

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Abstract

This literature review is an explorative examination of the current research related to how technology integration impacts the middle school classroom. With technology becoming more common in the home, work-pace, and school, studies highlighting the usefulness of these different tools are becoming a necessity for educators as they move forward with the development of the institution of education. This review covers multiple aspects of integration of educational technology in the middle school due to the fact that most studies were explorative in nature and or that the researchers were limited by aspects of their studies. In a broad sense, the general nature of the studies included, highlight the potential growth when integration of educational technology is done, yet the studies struggle to draw conclusive determination for what aspects impact education the most.

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CHAPTER I: INTRODUCTION

The classroom has evolved multiple times over the years. When I think back to the 12 years I spent in schools as a student, I can recall the multiple changes that occurred in regards to the tools used for my instruction. I have had classrooms that contained chalkboards, overhead projectors, whiteboards, a TV/VCR on a cart, which was then updated to a TV and Laser Disk Player. The computers have grown from green-scale apple computer labs, to computers in the classroom, the internet connecting everyone, now we have portable devices that students can use anywhere in or around the school. The classroom of today could not have been predicted by teachers ten years ago. What is true for education also matches with the global economy. The jobs of today were unheard of 10 years ago. Because of how rapidly technology improves and changes, teachers need to grow, adapt, and ensure that the youth of their classrooms are gaining the skills needed to be successful in the world of tomorrow. In order for educators to do that, researchers need to be continually observing and studying the effects of new devices, how they are used, and how to best support the staff that are using them. That is why this literature review will examine current studies relating to integration of educational technology within the middle school setting.

Research into educational technology is paramount to the development of our youth into well rounded individuals. In order for educators to complete this task, they will need to understand the various devices and tools that are currently available for students and the ways that they have been successfully introduced into the classroom. Fad strategies need to be identified so that teachers are not wasting precious time, on a

product, strategy, or program that will make the biggest impact on learning. In this article, research related to the different devices being utilized in the classroom will be reviewed. In addition, programs of an instructional nature as well as frameworks to help guide educators towards a blended learning environment will also be detailed in their uses. The final sections of this literature review, research related to perceptions of technology in schools and how it impacts teachers and students as well as journals that have addressed the different challenges and issues that arise as school districts incorporate more technology in their buildings.

The contents of this literature review will be broken up into four related groups. The first group will be related to the types of technology that are currently being used in classrooms. This will include physical devices such as mobile devices such as iPads, laptops, interactive whiteboards, as well as fabrication devices such as 3D printers and bowling machines. This section will also include a study on the use of the internet which would be considered a type of software as well as current frameworks used to guide teacher's in how to use these different types of technology.

The second sections will focus on how teachers can utilize different forms of technology to improve the learning environment. Studies related to instructional support in the form of modified lessons, supplemental resources and an organizational structure for classroom instruction and behavior management known as a "flipped" classroom. A core tenet of the second section will related to research in regards to how technology can support a teacher with feedback as well as tools and strategies for improving student motivation for a myriad of learning tasks.

The third section of the literature review looks into studies that focused on student and teacher perceptions of using technology in the classroom. This includes studies on the perceptions of teachers as they go through a classroom paradigm shift, moving their teaching structures from a contemporary model of lecture-based instruction to that of a “flipped” classroom as well as studies related to student’s perception of technology use in the classroom vs how they actually us it.

The final section of this literature review will review the challenges identified in the studies related to increasing use of technology in the classroom. This includes studies about educators training on technology, resources needed to complete the task, and the idea of transitioning mindsets from how we view technological devices to seeing them as tools for learning and growing.

Definitions

Throughout this thesis a variety of terms are used that are standard when engaged in the conversation of educational technology. These terms will be defined in the context of this essay to clarify meanings to the reader. Educational technology can be identified as any modern device or program that can be utilized for the purpose of enhancing or supporting a learning activity. Technology integration or tech integration is the act of incorporating these different devices and programs into the regular classroom. Examples of past tech integration would include using computers for student construction of essays, to having students construct a webtoon of a scene from a Shakespearean play taking place in modern times using a graphical program. Tech integration also requires understanding to what degree teachers integrate technology

into their classroom. This is referred to as blended learning, where control or origin of learning can vary from multiple sources including the teacher or different digital programs and tools. This can branch into something known as the “flipped” classroom. A “flipped classroom is a form of blended learning where face-to-face teaching is replaced by online access (Goodnough & Murphy, 2017). The goal of the flipped classroom is to design lessons that students can engage at their personal level, freeing up the teacher to engage students that are struggling with at level content.

Research Question

In the course of this study, the goal of this literature review is to answer questions pertaining to the impact of educational technology on the middle school classroom. The first focus will be on identifying the nature of current research in regards to technology integration. Identifying what areas of educational technology integration is important for planning the direction of future studies. The second focus for this review will be to assess the intensity of each study. There is a need to evaluate the intensity of each study. Understanding this aspect of research in the field can help guide future studies, which ones need to be expanded, what methods need to be expanded, and what areas caused challenges to the study, modifying the validity of the researcher’s conclusions.

CHAPTER II: LITERATURE REVIEW

Literature Search Procedures

To locate the literature for this thesis, searches of ERIC, JSTOR, and PsycINFO were performed in search of related articles published from 2000-2019. This selection of materials was reviewed, removing articles from further study if they were not peer-reviewed journals that were focusing on technology integration related to middle school students. They key words used in these searches included “middle school technology integration,” “technology integration teacher training,” and “academic technology middle school.” Individual searches were conducted for known or suggested programs related to the guiding questions. This chapter is organized as a review of literature connecting to 4 main themes: Types of Technology used in the Classroom; Technology as an Instructional Tool; Teacher/Students Perception of Technology in Schools; and Challenges of Growing Implementation of Technology in Classrooms.

Types of Technology Used in the Classroom

When looking at the types of technology used in the classroom, it was necessary to separate these into three categories: the devices used to integrate into the classroom, the common software, and the pedagogy of technology integration.

Technology Integration Devices

The classroom has seen its fair share of technological devices taking their place beside the educator. The past devices that trail blazed into education would include the calculator, overhead projectors, and the television. Modern technology has allowed even more complex devices to become available in schools for teachers and students.

These devices come in many forms, this review will focus on interactive whiteboards, mobile devices, laptops, and fabrication devices such as 3d printers.

Interactive Whiteboards. The overhead projector broke through the many challenges of the chalk-board that educators faced. This has now been made obsolete with the development of interactive white boards and projectors. Interactive whiteboards come in a variety of packages, but their overall purpose is to create a display screen that can be manipulated in different ways to meet the need of the educator. Interactive whiteboards enable students to improve their attitudes towards mathematics in a positive way and to increase their attention and interest (Onal & Demir, 2017). Onal and Demir (2017) observed an increase in student engagement and general motivation towards a given lesson when an interactive white board was used for instruction. In their study, data was collected from 726 middle school students through the use of two surveys on attitudes towards mathematics and towards interactive whiteboards. Interactive white boards have been shown to achieve this by making lessons more tangible and manipulative. Interactive whiteboards allow teachers to model the use of tools in a large class setting and they also have the capability of allowing teachers to demonstrate other tools or simulations that they would not have access to due to budgeting or physical space restrictions.

Laptops. As the trends with technology tend to be, technological devices became cheaper and smaller as time went by. They became more powerful, and the number of tasks they could complete grows by leaps and bounds. Schools have followed a growing trend of introducing computers into their learning environments for many years already.

In my schools this started as computer laps that were shared between the many teachers and classes. As laptops became more affordable for schools to purchase, shared mobile labs became the norm. Teachers could “rent” a classroom set of laptops for the students to utilize. The modern classroom is taking this a step further. In schools across the country, a 1-to-1 computing program can be found in districts and classrooms for students of varying ages. In the fall of 2002, more than 17,000 seventh-graders and their teachers in 243 middle schools had their fingers on the keyboards of laptops (Garthwait & Weller, 2005). This was the result of the Maine Learning Technology Initiative (MLTI) In this program each student in the school had a personal device that they can utilize for class lessons or assignments. During this transitional period Garthwait and Weller (2005) tracked the progress of 2 teachers through the use of interviews, observations, and artifacts provided. This opened up multiple new avenues for learning. Besides classic word processing, students had access to online websites for research, exploration, or interacting different programs. The laptops also brought about a new level of communication that could take place between school, student, and home (Garthwait & Weller, 2005).

A 3-year study in Korea by Hur and Oh (2012) observed that 1-to-1 laptops enabled more improvement among at risk and special-needs students. They also noted that motivation and class engagement also improved with the introduction on personal devices. Although they did measure an increase in motivation and class engagement from a majority of students, the greatest change occurred from this group of students. Hur and Or (2012) also investigated on the impact of introducing laptop devices on test

scores. The authors conducted their study using 82 participants split between two classes. Initial results of the study were showing a positive trend with the introduction of laptops. This pattern began to taper over and eventually led to a negative correlation. When interviewed, the teachers in the study revealed that they were able to create engaging lessons with the technology that motivated students into active learning at the beginning of the study. Pressure to prepare for state testing cause teachers to spend less time creating tech integration lessons. The challenges of integrating technology into the classroom will be further detailed in a later section.

Tablets. Besides laptops, tablets are another device that has been increasing its presence in school districts. Often less capable then laptops, tablet devices have the ability for students to do research, word process, utilize online programs, used to administer assessments, or be used as an electronic reader. With its multifunctionality and lower cost when compared to laptops, tablets have been utilized as a starting point for districts deciding to expand their technology program. Yet, with its many uses, it may not have the impact schools are hoping for in terms of reading ability. A study by Roser (2017) concluded that iPads when used as an e-reader application did not influence the overall reading achievement of middle school students. The focus of this study was measuring improvement in students' reading ability in terms of comprehension, accuracy and rate. The study took place in a singular school where three out of six teachers were running a blended classroom. This setup offered an experimental and control groups out of convenience. Although the focus of the study was to investigate the implication of iPads(tablets) on the reading achievement of middle schoolers, a

secondary finding was reported that would give support to the rise of implementation of tablet devices in schools. Students acknowledged that they participated more during the reading unit with their iPad than previous reading units when their iPads were not available for use to them (Roser, 2017). This motivation, if harnessed, could be the motivating factor to change a null impact on reading ability to a positive correlation impact.

Fabrication. Digital fabrication technologies can be classified into two categories: two dimensional (2D) technologies that use subtractive techniques to trim material such as paper or metal, and three-dimensional (3D) technologies that use additive techniques to literally print an object out of malleable material such as plastic or silicone (Smith, 2013). Examples of 2D fabrication include Computer Numerical Control (CNC) milling machines, laser cutters or engravers, and bowling machines, 3D fabrication tools are referred to as 3D printers. 3D printers come in a variety of forms varying on the material used in the construction and process of fabrication. Fabrication devices have been growing in popularity as a tool to help inspire student creativity as they apply newly learned skills and produce something tangible. In a study related to 2D fabrication, Smith (2013) observed the use of a bowling machine with a Paper Engineering Club (PEC). Over the course of the study the author engaged in 25 observations with the PEC and conducted ten interviews with the teacher. In the PEC, students read and explored professionally created pop-up books to get a sense of technique and structure. As the students embarked upon creating their own functioning pop-ups, they assumed the role of both author and paper engineering illustrator as they attempted to weave together

the visual and verbal forms of communication (Smith, 2013). Smith (2013) pointed out that this structure allowed students to explore visual-reasoning abilities such as visualization, to ideate and imaginatively construct ideas and "pictures of mind" while also exploring how their pop-up mechanisms would function. The goal of this study was not to measure academic growth but to find instructional strategies that would be effective at integrating similar technologies into a classroom. Smith (2013) noted that using the bowling machine with the PEC, promoted motivation and creativity among club members.

Software

For every piece of physical technology there are several more pieces of coded frameworks referred to as software. A majority of these forms of software will be included in the section titled Technology as an Instructional tool, where the individual programs and their use for education will be addressed. This section is going to focus on software that is commonly utilized by all or most programs, namely the Internet.

Internet. The Internet is one of the crowning achievements of the 21st century. It shrank our world to the size of a computer or mobile device. Through the Internet, people have access to a limitless supply of information on almost every subject imaginable. It also allows individuals from all across the globe to communicate and interact with each other regardless of distance. This inter-connectiveness opens countless doors for students and educators, as it gives access to up to date information for research, easy connectiveness between the home and the school, and allows schools access to simulations to provide tools that are not available. With all of the opportunity

that the internet provides, how can it be harnessed to better improve the lives of students and teachers. Alaseed (2017) wanted to find out to what extent mathematics middle school teachers in rural Appalachian region of a populous Midwestern state are aware of the importance in using the Internet in teaching and learning of algebra. Throughout three different buildings Alaseed, observed classes and interviewed teachers about their use of the internet. Alaseed (2017) concluded that this study showed evidence that teachers do not understand when and how the use of the Internet is important for students in teaching algebra. Some of the evidence reported in the article include restricted access to the internet and little to no guidance on how students can use the internet to support themselves in their learning. Only one teacher from the participants indicates that he or she is using the Internet for a purpose other than preparing for tests (Alsaeed, 2017). This is indicative of a lack of training that will be covered in a later section on the challenges of utilizing technology.

Instructional Framework

With-in the educational world, teachers use a collection of frameworks to help guide them to developing powerful instructional lessons and meaningful learning. With the introduction of an ever-evolving technology, new and technologically-minded frameworks needed to be developed. Two of the primary frameworks for tech integration are SAMR and TPACK.

SAMR. SAMR is a model to provide a framework for teachers designed on improving their integration of merging technologies into their daily lessons (Hilton, 2015). SAMR is an acronym related to the four tasks of integration; Substitution,

Augmentation, Modification, and Redefinition. While investigating the role of SAMR the author conducted their study at a medium-sized urban school district in southwestern Pennsylvania over the course of a single year. Hilton (2015) discusses that during his study, the participants has a misunderstanding of the framework, they viewed SAMR as a hierarchy of integration similar to Bloom's Taxonomy instead of list of types of integrations. Hilton (2015) suggests that SAMR appears to most easily connect to student-centered design in that each activity is examined for specific opportunities to imbed technology in a manner that improves the independent learning capacity of the students.

TPACK. TPACK is a framework used to allow educators to merge understanding of technology, pedagogy, and content knowledge into instructional lessons. The TPACK acronym stands for, Technological, Pedagogical, Content Knowledge. It is depicted as a tri-Venn Diagram focusing on the union of technology, pedagogy, and content knowledge. Hilton (2015) states that TPACK appears to more easily align with teacher-centered instructional design philosophies. Under the TPACK framework, teachers develop explicit lessons incorporating content knowledge, pedagogical knowledge and technological knowledge. Introductory lessons are used as a way to teach learning strategies, academic content, and technological skills. In a study on how teacher behaviors fit within the framework of TPACK, Wetzel and Marshall (2011) pointed out that students learned Keynote skills in the context of writing a newspaper article title with an action verb and keywords. Also, students learned video camera skills in the context of interviewing based on an analysis of newscaster interviews on TV (Wetzel &

Marshall, 2011). The authors continue with examples, highlighting the exposure student's get to incorporate real life skills through their learning task.

Technology as an Instructional Tool

With technological advances making steady growth in multiple directions, the instructional tools that teachers have access to vary. In the following section, these tools will be broken up by the realm of education they impact most directly. These sub-groups consist of technology as it relates to learning tasks, feedback, and student motivation.

Learning Tasks

In this section, articles related specific programs or the utilization of different piece of technology to enhance student learning are included. These tools consist of digital storytelling, lesson organization, simulated learning, learning programs, and tech organized lessons.

Digital Storytelling. One of the cornerstones of the technological age would be video sharing websites like YouTube. These sights give individuals the ability to create and share content with anyone interested. Educators can harness this tool for the classroom as well. In a study by Dreon, Kerper, and Landis (2011), they investigated the impact of short instructional videos made available for students. The study showcased that because the videos can be viewed in a private setting, students can repeatedly view material without fear of peer judgement (Dreon, Kerper, & Landis, 2011). Motivation was also considered a major impact of constructing learning objectives into small

videos. Students were more able to digest this information as it is more similar to the media that they consume on their own.

Lesson Modules. Osler, Hollowell, and Nichols (2012) conducted a study into the impact of technology engineering on science education. “Technology Engineering” is the combination of Learner-Based Tools, Educational Games, Educational Systems, Relevance, and Collaborative Learning Strategies to create an interactive and dynamic cognitive economy (Osler et al., 2012). These tools include guided inquiry maps, interactive visualizations, electronic discussions, and embedded assessments (Osler et al., 2012). Their study took place in an urban school district in North Carolina with seven teachers. The authors’ focus was whether students engaged in this module of learning could make improvements to the understanding of pre-taught knowledge. Their report shows a growth of 4 points on a 16-point assessment. Osler et al. (2012) added that student responses indicated a greater breadth and depth of knowledge that they could clearly articulate regarding the scientific concept. Developing a deeper understanding of content will allow students to transfer knowledge more easily to other or related contents. The study also includes a qualitative survey of the educators involved. The focus was what areas of educations view, act as a bottleneck for increased use of similar modular teaching. They were able to identify the top three concerns as access to computers, teacher apprehension about using technology, and network access and outdated devices. Overall conclusion addressed that through the use of the inquiry-based module, students gained significant knowledge from the TELS module on global

warming, autonomously of the limitations of their instructors and classroom environment (Osler, Hollowell, & Nichols, 2012).

Instructional Technology. Similar to the lesson modules previously reviewed, instructional technology began as a supplemental tool to assist teachers, it could be considered the starting point for the lesson modules. In a study conducted by Brasiel, Jeong, Ames, Lawanto and Yuan, multiple schools, teachers, and students took part in measuring the benefits of utilizing a supplemental math program. Almost 45,000 students were included in the analysis to measure the impact of six unique supplemental programs. The study lasted the course of a year and data was matched up with results of Utah state testing. In the study they conducted an impact analysis with an odds ratio that measures success favoring technology or control groups. That analysis indicated multiple programs that were providing significant improvement over others. Brasiel, et al. (2016) identified that the results from the first of implementation of mathematics educational technology show the promise of these types of programs in providing individualized instruction, practice, and automatic feedback to students. They continued by pointing out that with this technology, students and their parents have access to mathematics instruction that can provide remediation and acceleration (Brasiel, Jeong, Ames, Lawanto, & Yuan, 2016).

Computized Simulations. A perk to computerized education includes the ability to simulate an enviroment or procedure that might be out of reach for specific schools or classrooms for a myrid of reasons. These simulations also help bridge the gap between theory and real-world application as it can unfold in front of the students eyes

instead of a word problem with a barely relevant picture. Findley, Whitacre and Hensberry (2017) conducted research to asnwer the question of what purposes do sims serve in mathematics lessons, and how do teachers position sims to meet those purposes. The authors define interactive sims (sims) for mathematics as dynamic enviroments that model a mathematical conept, relationship, system, or phenomenon and allow users to interact with the model within that environment (Findley, Whitacre, & Hensberry, 2017). When creating the framework for their study they drew inspiration from the SAMR model mentioned earlier in this paper. From that, they were able to derive 3 major integrations; supplementing, enhancing, or driving. To answer their research question, the authors used a large public charter school as their research sample. The researchers observed three mathematics teachers who were new to using sims, had them construct and utilize 11 diferent lessons usings sims to engage learners and enhance learning. From those lessons the reserachers coded the different lessons within their intergation catagories. Findley et al. (2017) found that there are fundamental differences in how each teacher chose to position sims and in their related pedagogical beliefs. Where as each integration has its merits, the frequency of use will be related to the educators' personal stance on technology and sims as a tool.

Math Snacks. Math Snacks is a math supplemental program designed to utilize short videos and interactive web-based games. The goal of the study was to determine if Math Snacks' videos and games would show growth in mathematical knowledge of target areas (Valdez, Trujillo, & Wiburg, 2013). Nine teachers and 460 6th and 7th grade students from two school districts agreed to participate in the study. Students received

instruction over an eight-week period. Some classes utilized math snacks and other classes did not. A pretest and posttest were used to measure starting and ending data. The results from the study ended up showing no significant data that Math Snacks plays a role into student achievement. When comparing data from 6th grade students both control and experimental groups made comparative growth of the eight-week period. When comparing the 7th grade group the experimental group significant growth compared to the control, but there was a discrepancy when comparing pretest and post results between the two groups. The control group scored substantially higher than the experimental and made minor growth. Although the growth was less when compared to the experimental group, the post test results for the control was higher than the post test results from the experimental groups.

Flipped Classroom. While previous topics discussed were specefic pieces of technology utilized by teachers to enhance learning, the flipped classroom is a structure in which educators can present the different tools and programs highlighted earlier. A flipped classroom is a form of blended learning in which standard classroom practices, such as lecture, inquiry, or small group interactions are replaced by an online access (Goodnough & Murphy, 2017). In their study, Goodnough and Murphy (2017) attempted to observe and document as teachers make the transition to "flipping" their classroom. In the study, four teachers participated. They were granted a small budjet to procure any materials or equipment needed for their classroom transition. They were also granted release days from teaching duty to engage in personal research on the

flipped classroom in an effort to develop resources and their method to achieve this change (Goodnough & Murphy, 2017).

The study organzied its findings into four catagories; Who is learning, Why Do They Learn, How Do They Learn, and What Do They Learn. The first two catagories give background for their information but do not nessacarily add to the goal of their study.

The “How” section shows the devleopment of new skills between the different educators. Some of the key take aways from their journey was the progression from utilizing materials made from others to self created artifacts; the need for a learninging community as all participants commented about their constant communication with eachother, sharing ideas and asking for feedback. This support team was shown to guide different members with their growth and provide confidence when a member was struggling.

In the section on What Do They Learn, Goodnough and Murphy (2017) provide exerts of the successful experience transitioning to a flipped classroom from the 4 teachers. These anecdotes bring the message that not only do the teachers feel successful in their transition to a flipped model classroom but that the change they endured also led to better engagement and improved learning for their students.

Feedback

A pivotal piece to any learning cycle is feedback. In general, humans learn, on a trial and error method. The feedback received when someone is developing their understanding of the world and the different skills utilized in it, helps guide that path to understanding and mastery. Technology is being used to make that feedback more

readily available to learners so that their education is not dependent on a teacher. These sections will address feedback in terms of guidance through a learning process and constructive feedback.

Feedback types. As mentioned above, feedback is a crucial piece to the learning process. This feedback can be delivered in multiple variations with different levels of support. Educational technology offers a unique advantage to the student and the teacher. In a traditional setting, feedback is commonly offered to the learner during correction of homework problems and in class practice. With the development of online or digital academic programs, student can engage in learning in or out of the classroom. They can receive automated feedback that has been constructed on the basis of the answers given by the learner. Fyfe (2016) decided to investigate how different types of automated feedback can impact the learning of middle school students. The study involved 143 students from two teachers' classes of 6^{th} and 7^{th} grade students. The researchers administered pretest and posttest to monitor changes over the study. Students were randomly assigned one of four feedback variations to support them in their homework assignments. The researchers focused on no-feedback, correct-answer feedback, explanation feedback, or try-again feedback for this study (Fyfe, 2016).

At the end of the study, the author was able to come to two conclusions and verify a commonly held believe. The author was able to measure the success from utilizing three types of feedback. This reaffirms the positive impact that feedback creates in the learning process. The first conclusion the author made was related to the effectiveness of feedback with low-knowledge students. Based on the results from the

study, Fyfe (2016) stated that “basic correct-answer feedback resulted in the best transfer for low-knowledge students…” (p. 587). The author continued by indicating that for some students, too much information related to feedback can cause as a distraction or demotivator causing students to lose focus. Correct-answer feedback informs the learner of the right answer if they made a mistake, this might aide students in connecting dots where they make mistakes or could also allow them to compare how close they were to the correct answer. The second conclusion the author was able to make relates to feedback and high-knowledge students. Fyfe (2016) observed that high-knowledge students sometimes do just as well without feedback during problem solving.

The author believes that continue research in this area would lead to better understanding of feedback’s role in the learning between students including low-knowledge and high-knowledge students.

MUVE. Multi-user virtual environment (MUVE) is an interactive digital medium where the users can engage in collaborative exploration. This idea is an offshoot of game-based multiple-user dungeons (Nelson, 2007). In an educational MUVE, students are able to engage in a digital environment that has been designed around learning objectives.

In a study lead by Nelson (2007), a MUVE by the name of River City was utilized. In River City, the students are learning about the development of illness through a community in the 1800’s. Students will engage a digital world, using visual clues, audio clues, or dialogue presented by the program to determine cause of illness and how it

can infect and spread throughout the community. The focus of the study was to identify what is the correct level of guidance students need in a MUVE to successfully complete the learning objective. Two concepts within constructivist methodology were identified as the measures of the study; a hands-off student led discovery vs a discovery with "clues."

Constructivist followers of the "Without Information Given" constructivism mindset believe that students should construct personal interpretations of the world in a 'discovery learning' mode, absent of any overt guidance. This viewpoint was applied to the MUVE by allowing students to engage in the program without any digital supports or guidance.

Another form of guidance measured through the study was a "self-directed" or reflective guidance (Nelson, 2007). This guidance gives reflective tools to support hypothesis generation and testing processes without giving direct answers or making judgments (Nelson, 2007). The implementation of this guidance was to offer hints to students as they interacted with the MUVE. The authors predicted that the hints would guide students to the learning objective.

The study included 287 middle school students. They were split between three groups of no guidance (control), moderate guidance, and extensive guidance. The difference between the two levels of guidance related to the number of hints students could gain when interacting with the MUVE. When completed the authors concluded the impact of the guidance was not statistically significant. Authors believe that their results may not be valid as students did not utilize the system as it was intended.

Descriptive analyses suggested that students in the two treatments with exposure to guidance system did not tap the guidance at a significant level (Nelson, 2007). The author pointed out that the moderate guidance group had a total of 200 guidance interactions and the extreme guidance group had 600 through the entire program. The average guidance utilized by the students was 12 for moderate and 15 for the extreme. The author later concluded that they still felt that continued research in this was important but researchers will need to focus on factors that influence a student's decision to use guidance as they explore the MUVE.

Attitudes Relation to Learning

Educators have long known the importance of motivating students to help engage them in lessons. Traditionally this has been done through the use of "hooks" or high interest attention-getters, connections to prior knowledge, related to personal interest, or competition. The mere act of introducing technology was a motivation inducer at one point, but as technology became more prevalent in the every day life of students, the novelty of it faded away. In this section, research related to engaging students and improving academic motivation will be discussed.

Personalization and Imagery. Practice problems are an integral part to mathematics education. Educational technology has been progressing with new ways to allow students to practice and explore a variety of skills and concepts. With this growing variety of tools available to educators, research looking into the what works best with students or how to enhance current tools. With consideration to these goals, a study was conducted to address the issue of motivation related to visuals and personal choice.

Walkington, Clinton and Mingle (2016) conducted research to view the impact of these issues on student learning and motivation.

The first study contained a sample of 265 sixth grade students. The objective was to measure the effect of illustrations with practice problems to gain mastery and transfer the skill to problems without illustrations. In the study students were spit up into four different groups; Diagrammatic Illustrations, Contextual Illustrations, Misleading Illustration, and Irrelevant Illustration. Diagrammatic Illustrations are illustrations that contain mathematical information like a number line or a shaded area model. Contextual Illustrations include representative information that relates to the story but does not contain mathematical information. Misleading Illustrations contain incorrect mathematical information in the form of irregular scale factor or missing details. Irrelevant Illustrations are illustrations that have pictures that hold no connection to the story or mathematics of the problem. Walkington et al. (2016) concluded that although Diagrammatic Illustrations brought about higher performance on practice problems, when students conducted the post-assessment without illustration there was no significant different between the four groups. Walkington et al. (2016) pointed out, “Diagrams that contain mathematical information enhanced student performance for one of the problems, but only in the short term” (p. 94). In regards to motivational purposes, the authors found no conclusive data that the images help engage learners.

The second study involved 223 sixth grade students. The goal of the second study was to measure the impact of customization within practice problems for a math

class. In this study students were split up randomly into four groups; standard word problems from the unit, a condition where problems are based on personalized topics, a condition where students are randomly assigned a topic, and a condition where students can choose a topic before seeing the question (Walkington et al., 2016). The results from the second study shows that students that got to choose the topics involved in the math problems and the students that were assigned a personalized topic outperformed the control group. In regards to motivation, the group that got to choose their topic showed higher motivation when compared to the other variations.

Robotics Interventions. In the study conducted by Nugent, Barker, Grandgennett, and Adamchuk (2010), students engaged in a week long summer camp dedicated to robotics and geospatial technology. In this study the researchers wanted to compare the motivational increases towards science, technology, engineering, and mathematics (STEM) learning and attitudes between individuals that did not attend the camp, those who did attend the camp, and those that attended a three-hour introduction to robotics. The participants were students from the state of Nebraska, this would qualify as a convenience sample as students who were already interested in robotics signed up for the camp. One hundred forty-seven students attended the robotics camp, one hundred forty-one students attended the three-hour intro class, the control group consisted of the one hundred forty-one students that attended the intro course, but they measured their attitudes towards steam before the class.

Results relating these STEM interventions to STEM learning were as expected. Nugent et al. (2010) states, “Students participating in the week-long intervention clearly

increased their STEM learnings, as measured by a content test covering topics in computer programming, mathematics, geospatial technologies, and engineering" (p. 402). Other benefits from the week long intervention also included greater ability when working with robotics. Although academic gains in STEM related task did not show any significant growth from the short-term intervention, there was substantial evidence of increased motivation towards STEM as well as increased interest. This resulted in the authors concluding the importance of short-term STEM interventions to engage students in STEM and make them more aware of the opportunities related to these fields (Nugent et al., 2010).

Video Length. Earlier in this paper, the use of online videos as instructional tools was discussed. Continued research in that area has uncovered that although videos can be a useful tool, if the videos are not made with care, they could be underutilized making the effort in constructing them not worth the gains they provide. In a study conducted by Slemmons et. al., (2018), they investigated the impact of the video length on the learning gains as well as improvement to motivation and attitudes of students. The study was conducted over two school years, with two middle school science classrooms in the upper Midwest. Three hundred eighty-one students were split between long video and short videos groups over these two years.

At the end of the study, the authors reviewed the results to determine that although the short video group did have a higher average of test scores when compared to the long video group, these differences were not of a significant value to claim that the short video aided in better learning. When students were surveyed about their use

of the videos, a competitive edge was given to the shorter videos, as students documented that they did prefer multiple smaller videos. They stated that they were more engaged, more likely to stay focused for the entire video, and more likely to replay a video to aid in understanding (Slemmons et al., 2018).

Gameplay and Narration. One of the many challenges that technology integration faces would be that student's default opinion on computers and mobile devices is of entertainment. There is a level of dissonance between seeing these devices as educational tools instead of entertainment tools. One way to bridge this disconnect would be to incorporate educational learning in a game format. A study was conducted in January of 2013 at a middle school in Greece by Garneli, Giannakos, and Chorianopoulos (2017). The goal of the study related to three aspects: What effect does playing serious games have on students' attitudes and performance; How does the storytelling game element relate to students' attitudes and performance improvement; What impact of employing a serious-game playing/modification approach on students' intentions to engage in playing the game?

The study consists of 80 students in the first year of middle school from north-western Greece. Students were split up into four groups of twenty. One group of students played a storytelling game, a second group played the same game but without the story telling element, the third group played a game similar to group one but was able to change the game code, and the fourth group practiced skills in a traditional setting (control).

When reviewing the results of the study, Garneli, Giannakos, and Chorianopoulos (2017) observed no significant correlation between story-based games a nonstory-based games. They were able to document significant improvement in student's attitudes from the coding group. In their interviews, the authors were told that the students enjoyed being able to alter parts of the story in the learning game. This led to students replaying the game multiple times because they could change the name and appearance of the different characters (Garneliet al., 2017).

Real-World Application. One of the many goals of an educator is to teach students skills that they can then transfer to a real-world application. Sometimes, it might be more effective to teach the real-world application and have the students use that to practice the skill related to the content. In a study by Wetzel and Marshall (2011) that event unfolded as they were observing if teachers show evidence of behaviors that fit with the TPACK framework.

In the study, the researcher observed an educator over the course of a six-week cross curricular project on the Renaissance. The observed teacher was responsible for 140 students in a language arts class. The activities provided had students producing four stories related to information learned on the Renaissance. The project was organized as a news agency. Students could write articles for a newspaper, radio production, tv production, or podcast production. In order for students to successfully use these tools instruction and exploration took place for them to become familiar with it.

During this project, the author observed students utilizing job-related skills to showcase what they had learned in another class. Wetzel and Marshall noted "students learned Keynote skills in the context of writing a newspaper article title with an action verb and keywords" (p. 80). Students also needed to learn how to operate a camera in the context of a TV newscaster style interview. Although student motivation was not measured in the study the anecdotal evidence provided would prove that continued research would be beneficial to the educational community.

Perceptions of Technology Use

No matter how technology changes and improves, it will never be utilized to its full potential or at all if those responsible do not believe that it can improve their job. This is true for any profession and especially educators. In this section, studies related to different perceptions of technology in the classroom will be reviewed. The common themes found in the research related to the perception of technologies effectiveness as an educational tool and the perception of how the use of technology is evolving the role of the teacher.

Perception of Effectiveness

If educators believe a tool will make them more effective at their job, they will use it. This often comes from a practical approach. "I have used it before and gotten good results, I will continue to use it," is a thought process shared by many educators. This creates roadblocks as new techniques for education come forward or new needs are determined in the schools. This section will focus on perceived effectiveness of tech integration and how it changes. This review will address the perceptions of when to use

tech integration, the impact of tech integration and classroom management, and the specific role of technology in the math classroom.

When to Use. When reviewing the concept of when to use technology, teachers often fall to "factory setting" or what they are normally comfortable. Teachers that use technology more freely will continue to integrate it into their class while teachers that limit it to word process will also continue "business as usual." In a study by Swallow (2017), a Catholic schools began the process of developing its educational technology department. The author wished to determine the influences of technology on Catholic school teaching practices. In the study four teachers were observed for parts of two school years. During this time the school implemented a shared computer lab during the first year and one-to-one devices during the second year.

Of the four educators, only one of them was originally excited about the new tech program, with the majority of educators indicating they felt that traditional techniques were sufficient. During the study, the author provided support and guidance in utilizing their new devices into their content areas. Over the course of the year, perceptions began to shift about technology as the teachers observed the positive effects they bring. "Sharon stressed that allowing students to solve problems independently on a "smaller tech scale" enhanced their ability to collaborate and solve problems across a larger spectrum." (Swallow, 2017, p. 170). The improved devices also led to a shift in the student teacher relationship as students began appealing to their peers for assistance before reaching out to the educator or that the educator would

reach out to the students to find assistance on technologies that they were not familiar with (Swallow, 2017).

These shifts in perceptions were evident in all content areas except for the teachers that also taught a religion class. The author observed that these teacher gladly integrated technology into their other content courses, but when it came to their religion class they were either in purposeful avoidance, excitement but non-use, or indifference (Swallow, 2017).

Classroom Management

In the classroom, the organization of your lessons alters the different classroom management strategies you need to have in place. This is true when an educator does a lecture-based class, group project-based class, and this is also true for when a teacher integrates technology into their classroom. Tas (2017) conducted interviews with candidate teachers as they observed other teachers to study perceptions of classroom management problems when comparing traditional and technology-supported classrooms.

The candidate teachers were able to observe a variety of behaviors during this study. Some of their findings include that technology supported classrooms had educators that were more likely to change methods and techniques if they viewed the students were struggling with the lesson; That students showed more signs of boredom in traditional classrooms; Students appeared to be more attentive in technology supported classrooms which also lead to increased participation (Tas, 2017).

Although most of the observations indicated that classrooms with technology were overall a more positive experience, their surveys indicate that it does not impact all concerns they were hoping to address such as disturbing peers during the course, talking without permission, or coming to class on time.

Role of Technology in Math

A study on how professional development can influence an educator's perception of using technology in the classroom was conducted of six middle school mathematics teachers (Kul, 2018). The objective was to monitor individual stances of tech integration for their math class while attending training on the use of an online math program GeoGebra. All teachers were selected on a voluntary basis and attended a 22-hour workshop.

During the training teachers were slowly exposed to the GeoGebra program and how it could be utilized. At the beginning, middle, and end the participants were interviewed on their beliefs of mathematics and reasoning for teaching and learning math.

Over the course of the training teachers that originally indicated the rigidity of mathematical instruction started commenting on different ways to approach teaching math concepts. Kul (2018) noticed that "…more than half of the participants became more open to accept to ideas of constructivist perspective and reported some form of shift" (p. 238). The researcher later concluded that although during the training, educators seems to be making a shift in their thoughts on using different technology in

the classroom to support their teaching, obstacles such as time and standardized testing are likely to hinder teachers from pursuing changes to their classroom (Kul, 2018).

Challenges of Technology Implementation

As with everything in life, there are pro and cons. Technology integration in the classroom comes with its own share of challenges. In this section, studies related to roadblocks related to tech integration will be explored. These challenges will consist of training needs, adequate resources, needs for collaboration, and transitioning the educational mindset.

Training

Throughout multiple articles for this review, themes related to training were often commented on by the authors. As with all new techniques, products, and frameworks, proper instruction into their uses is necessary for successful implementation. In his study, Kalonde (2017), collected data on 63 math and science teachers throughout southern Illinois through a mail-in questionnaire. The researcher wanted to identify what rural middle school teachers perceived technological skills, their perception on technology straining, and what professional development (PD) they have been provided by their respective districts.

After analyzing the results from the questionnaire, the author was able to identify a handful of patterns related to the study. Overall a vast majority (76%) of educators said they have received 0-10 hours of PD related to training with technology hardware and 90% of educators responded that they received 0-10 hours of PD related

to technology software (Kalonde, 2017). When taking into account that this data represents the accumulated time spent at the district, with 90% of teachers responding they have been with the district 1-10 years, this would indicate a low priority for tech PD in their districts.

The overall conclusions from Kalonde (2017) include that educators have identified the importance of technology integration in the classroom. He would also point out there is a concerning lack of education and training as to how to properly incorporate these devices and software into academic lessons. Kalonde (2017) calls for continued research in this area, pointing out that "The curriculum should require teachers together with the students to use technology as an integral part of their classwork and in a manner that enhances their creativity and learning of higher-order skills," (p. 24).

Adequate Resources

Even with extensive training, challenges will occur for teachers integrating technology into the classroom if the schools do not have proper resources for the integration. This commonly comes in the form of having enough devices that are capable of running the programs needed for the class, and technology support staff to assist with issues as they arise. In a qualitative study conducted by DiCicco, Cook and Faulkner (2016), middle school teachers were interviewed about their understanding of what it takes to teach middle school students. In these interviews, teachers discussed what it means to be a middle school teacher, what success looks like, and what challenges they face. Among those challenges lies incorporating technology.

Participants discussed the need for current technology, pointing out that they are unable to incorporate devices in the classroom because they are too out of date to function with modern programs. Another participant pointed out the number of devices limits what can be incorporated. When teachers have to share a single lab between all other educators in the building, teaching flexibility is reduced and learning falls into a more rigid time frame.

In the article about module-based learning by Osler, Hollowell, and Nichols (2012), challenges were identified related to incorporating instructional modules into the classroom. Those challenges were comparable to those found in the work of DiCicco, Cook, and Faulkner (2016). “Several teachers reported that they had limited or no access to computers in their classroom, they also stated that there were not enough computers for the entire class unless the students worked in pairs or small groups of 3-4,” (Osler et al., 2012, p. 36). The lack of support from an in-house technical support individual also made challenges for teachers when computer related problems occurred such as website restrictions, connectivity, or updating software (Osler et al., 2012).

Collaboration

The field of education has always been at its best when teachers collaborate. Over time those collaborations started to collect into a series of techniques and strategies that help improve academic performance that became standard practice. As tech integration becomes more and more common among school districts there is a greater need for educators to collaborate beyond the confines of their home building or district. In a study conducted by Taylor and Duran (2006), they observed a 4-year

program that allowed public school teachers as well as faculty of a university work together in sharing, discussing, and reflecting on tech integration in the classroom. The project included 257 educators from the Michigan area. The participants were grouped in content related cohorts, that would receive instruction on specific programs or hardware, then they would create lessons to use those new tools. Cohort members would share their ideas along with how it played out when they implemented in class. "the exchange of ideas between the participants led to a greater understanding of how technology can and is impacting education at all grade levels and in all subject areas," (Taylor & Duran, 2006, p. 14).

A secondary impact this program had with educators was showcasing what technology and devices different schools have. Due to education funding in Michigan, discrepancies in technical and other resources between low- and high-income school districts exist (Taylor & Duran, 2006). This led to some districts with lower budgets identifying programs and devices that have made huge impacts in the classroom. This inspired educators and administrators to look at budgets and grant options to pursue acquisition of similar tools.

Transitional Mindset

Earlier in this paper, the perceptions of technology were discussed, in this section the challenges of those perceptions will be reviewed in the areas of how they impact learning.

Bartholomew and Reeve (2018) conducted a study on the perceptions of students and use of mobile devices in class. Their study included 442 middle school

students from 5 different schools. Students were given an initial survey and then were allowed to use their mobile devices during a two-week project. Students that did not have their own device were given access to one. One of the key objectives of the study was to look for differences in student perceptions of mobile device use in the classroom compared to actual use of devices.

In the initial survey, only 11% of students indicated they would not use their device in class even if allowed. The remaining class said that they could use it to send files to another person, access information through the internet, learn a new skill, communicate with a peer or create videos (Bartholomew & Reeve, 2018). This conflicts with the recorded device usage of under 30 minutes for the entire two-week project for 67 % of the students. Students explained that although they think they should be able to use mobile devices in school they identified that they did not use them due to the negative consequences they considered such as using it for off-task behaviors. (Bartholomew & Reeve, 2018).

Bartholomew and Reeve (2018) found that their research demonstrated a possible disconnect between the data and suggest further research. They suggested that continued exploration into why students do not choose to use mobile devices yet have an overwhelming desire to access would provide helpful information to decision-makers on device policy.

A similar study related to shifting the mindset for tech integration related to the study of a web-based intelligent tutoring structure system (ITSS). In this study, Wijekumar et al. (2005) conducted research into fifth and seventh grade students

utilizing ITSS in comparison to their use of other computer tools. Participants completed surveys on computer usage and then worked on three lessons that utilized ITSS. Afterwards they were surveyed again about how often they used the program. Although students enjoyed using the program and would like for it to be available for subjects other than reading, they also mentioned that using the program routinely or over a long period of time would be boring.

Through interviews and comparing survey data, a clear pattern became evident for researchers: most students in the study view computers and other devices as a tool for entertainments. This was highlighted in the comparison of 10-30 minutes a week of students completing school related tasks on a computer compared to the 10-15 hours spent on games (Wijekumar, Meyer, Wagoner, & Ferguson, 2006). Researchers noted patterns of computer game use as a reward for completing work used in both schools and at home may have helped build this mentality. Although no clear suggestions to shift this mindset, the author focused more on how to get students to engage more with ITSS to capitalize on the gaming mentality for academic purposes.

CHAPTER III: DISCUSSION AND SUMMARY

Summary of Literature

The research collected for this literature review focused on studies of educational technology integration into the middle school classroom. During the researching phase, a pattern arose of common themes in relation to the research question. Those themes were identified as physical technology, software, perceptions, and the challenges related to integration of technology in the classroom.

In the areas of physical technology, studies were found related to smartboards, laptops, iPads, and 2D fabrication. A commonality of these devices was identified by the authors for their use as a motivational tool (Garthwait & Weller, 2005; Hur & Oh 2012; Onal & Demir, 2017; Roser, 2017; Smith 2013). In their studies, the researchers described that the use of these devices often motivated students for a variety of reasons like novelty and a connection to related interest. In the study by Onal and Demir (2017), students responded about how engaging math with a smart board had made the class more interesting and easier to stay focused. They expressed that because of the device, they felt that learning math had become easier (Onal & Demir, 2017). In a study about tech integration in South Korea, Hur and Oh (2012) interviewed student about their use of laptops in school. Their responses repeated a similar message of how it was easier to engage in class with the devices or that they were curious to see how they would interact with their devices as it related to their class (Hur & Oh, 2012). A similar study conducted by Garthwait and Weller (2015) looked at the changes in two teachers' classrooms as their districts expanded the technology department due to a state-wide

initiative. One of the teachers reported that when using computers as a learning tool, his students were able to be more creative in how they showcased their learning and completed assignments (Garthwait & Weller, 2005). Roser (2017) conducted a study on the impact of iPads in a reading classroom. Although her study concluded that the devices themselves do not lead to higher comprehension or understanding, she shared several bits of anecdotal evidence that the students enjoyed reading more with the devices (Roser, 2017). Smith (2013) conducted a study looking at how TPACK framework aligns with fabrication integration. During the process of this study an afterschool club learned and created their own pop-up books with the use of 2D fabrication. The study exposes that this club was able to get students to not only practice literary devices as they created their own books but they also implement the engineering and design process as they investigated pop-up features and attempted to integrate what they learned into their own books (Smith, 2013).

The next theme identified was that of software, which was also the most common theme identified during the research stage. The software programs tended to focus on at least one of three sub-themes; academic purpose, feedback, engagement. Software designed for academic purposes come in a variety of variations. This gives educators a large variety of tools to use. The tools discussed in this review include; creating videos for online learning, instructional modules for learning content skills, and simulation programs (Braisel et al., 2016; Dreon et al., 2011; Findley et al., 2017; Osler et al., 2012). In regards to feedback, a few studies used in this paper addressed the issue of computer-generated feedback and how students best respond to it (Nelson, 2007; Fyfe,

2016). Their studies looked at the level of availability of feedback and the level of support the feedback provides to the learner. The final sub-category when looking at software integration relates to student motivation through technology. The idea of using technology as a motivational tool was common amongst most studies. Several studies investigated the motivational impact of visual related technology such as videos, animations, and images (Slemmons, et al., 2018; Walkington et al., 2016; Valdez et. al., 2013). Other studies focused on engaging learners through personal connection and interest. This unfolded through use of robotics (Nugent et al., 2010), real world application (Wetzel & Marshall, 2011), and personalization (Garneli et al., 2017).

Several studies focused on the importance of perception of educators and learners in regards to technology. These studies could be further split into looking at teacher perceptions and student perceptions. When investigating teacher perceptions, researchers noticed patterns that educators with less experience using educational technology had a lower opinion of using educational technology in the classroom, while educators with more experience utilizing these tools had a higher opinion of them (Baker & Baker, 2004; Swallow, 2017; Tas, 2017). This trend continued with studies that offered training and collaboration to improve understanding of integrating technology into the classroom showed a rise in positive perception of technology (Jalali et al., 2014; Kul, 2018; Swallow, 2017). Student perceptions were often the most confusing for researchers. This showed in a study by Bartholomew and Reeve (2016) in which students identified their desire to use mobile devices to improve learning but when given the option many opted not to. This is finding can be connected to a study involving

an interactive tutoring program. In that study students showed interest in using a programed tutor to aide them in a learning task yet many students average 10-30 minutes per week compared to their 10-15 hours per week of electronic entertainment (Bartholomew & Reeve, 2018).

The final theme identified during the research process related to challenges and potential solutions. The challenges identified throughout the studies focused around training and resources. When reviewing the training level of educators most are lacking current or integration style professional development (Alsaeed, 2017; DiCicco et al., 2016; Kalonde, 2017; Taylor and Duran, 2006). The researchers pointed out that many educators having minimal training from teacher preparation courses or from district led professional development. Kalonde (2017) was able to interview multiple educators from a wide range of experience levels, his study revealed the lack of training was wide spread and that educators that had the drive, money, and time had to pursue additional training through outside sources. Limitations on resources was also a common bottleneck for integration process. Challenges with enough devices that were capable of running modern programs, internet connection, and support staff with reoccurring concerns found within the research (DiCicco et al., 2016; Hur & Oh, 2012; Roser, 2017; Osler et al., 2012).

Alongside the challenges, some authors have provided support on possible solutions. The challenge of training and changing the framework of a standard class into an integration class can be met through multiple means. In the research for this essay, three such frameworks were exposed; Flipped Classroom, SAMR, and TPACK. These

three frameworks are about organizing the thought process for what learning needs to take place, what tools or integration can be used and how are they used (Goodnough & Murphy, 2017; Hilton, 2015; Wetzel & Marshall). Their studies went through the process of how educators could use each idea as a template for integrating technology into the classroom.

Limitations of the Research

During research for this literature review, I decided to focus on studies related to technology integration for academic gains. Using journal databases such as JSTOR, ERIC, and PsycINFO, I searched for studies related to my focus. During my investigations for relevant studies, further filters were added to narrow on the objective of this paper. I started focusing on articles that either included middle school students or were relatable to the middle school setting.

Research in this field appeared to be very exploratory. Many of the articles indicated the open field of researching educational technology, so much so that they often concluded that more research needs to be completed in regards to their objective. I concluded that many of these studies are introductory and are in need of expanded research based on repeated concerns I encountered with multiple studies. A common limitation that I encountered while conducting my research was a challenge with the methodology of the researchers. The studies I included were found to contain either small sample of participants in which researchers could conduct their research with or grouping of convenience. Although this is understandable due to the challenges of scheduling middle school classes. It does lend to the challenge of validity of the findings.

Should the studies be repeated with either a larger sample size or non-convenience grouping, the author's conclusions would hold more weight.

Implications for Future Research

There are multiple areas that future research can be conducted. The main focus areas I would suggest would be related to effective training practices for teachers and support personal. I would also like to see researchers expanding previous work but with altered methods.

Throughout the course of this academic review, I encountered many indications of inadequate training in technology in regards to teachers integrating technology in their classroom. The articles reviewed included simple comments from participants, expressing their lack of training or experience with a variety of devices, software, or webtools to participant sharing personal believes about education and where technology fits that leads one to a conclusion of not enough educators have experienced quality training in educational technology.

As indicated in the limitations of research, many of these studies included some layers to their methodology. Many studies included participants that were samples of convenience or samples sizes were relatively small. To verify findings of the original authors similar studies, need to be conducted using a larger collection of participants or with a more random grouping of participants. I feel that it is much harder to conduct these studies in groupings not organized by convenience due to the nature of schools, class sizes, and student scheduling. This is why I stress the need for large collection of participants to help give the results more validity.

Many of these studies could also be redone with some alterations to the original setup. I indicated that physical resources and training were a limitation with-in the research. Many studies mentioned that physical technology road-blocks often challenged their progress through a study. It would be beneficial to educators if these studies were replicated with support given to the participants in regards to device reliability, internet connection upgrades, as well as appropriate support to deal with challenges that the educators face while instructing with technology. Couple this with the increased training I mentioned above, and researchers would have a better idea of strategies that are not successful from strategies that need correct support and training to utilize.

Implications for Professional Application

With current trends in the workforce leaning towards jobs that are either created with new technology or utilizing technology to support or complete related tasks, educators are going to need to make students aware of and fluent in the use of basic technological devices. This is why the research shared in this article will be useful to myself and other educators. Much of the research in this article opens doors for teachers looking for ways of starting or enhancing their integration of educational technology. I also feel that the findings of these articles give markers for educators and districts to work towards as they attempt to enhance their learning environment.

The research related to techniques and strategies in regards to physical tools illuminates a path that educators and districts can travel during their process of developing their technology department. Identifying that iPads hold no correlation to

improved reading comprehension but improves motivation towards reading indicates that electronic readers for a whole building would be wasteful spending, yet purchasing some devices for an intervention-style class where student's might be struggling with motivation could allow a new angle for teachers to reach out towards their students. This also holds true when discussing the more non-traditional technology such as fabrication devices. These devices are not as commonly seen districts due to costs of devices, materials, software, and training needed to operate them. They are also often pigeonholed into a STEM-only niche within education. The research provided in this literature review showed on these devices could be expanded into the language arts and used to tap into student creativity and ingenuity.

The studies related to the variety of digital programs used to meet the needs of students in a variety of content areas. I found two major benefits from these studies. The first benefit is the simple context of what programs are successful, which ones need more research, and which programs are unsuccessful. This will aid teachers and district in purchasing of a variety of programs as well as organizing classes and interventions needed for students. The second benefit is connected to any teacher that is moving towards a blended classroom. Multiple of the studies discussed, show correlation to modification of traditional practices that can be utilized and improved upon with the use of educational technology. This was expressed in the concept of making instructional videos for student learning, utilizing automated feedback, or gamification of the learning process. All of these studies included bits and pieces that educators can take, modify, and incorporate into their classroom as they develop their materials.

Many teachers struggle with tech integration into their classrooms. As addressed earlier, researchers found that this relates to the amount of experience when using technology. This creates a circle of frustration, teachers do not feel comfortable utilizing new tools in their class because they do not have experience using them, but because they do not use them, they never develop the experience needed for them to feel comfortable. By sharing the studies related to teacher perceptions of learning, educators can witness the growth and development that takes place with the participants as they learn how to use new devices and incorporate it into their classroom. This is also very meaningful for districts and administrators, as they can few the amount and level of support given to teachers that successfully grow as blended learning instructors.

Conclusion

When addressing the issue of how technology is impacting the middle school classroom, the simple answer would be to see it impacts it a lot. A variety of devices and programs are being created and released to the public at a constant rate. Students are engaging with technology on a daily if not hourly basis. The digital tools created and used will impact our world as much as the written word impact the world of our past. Taking into account the first research questions of this literature review, what is the nature of current research in regards to technology integration? The studies discovered during this literature review showed a wide spectrum of focus within technology integration. Many studies were focused on different aspects within technology integration. Due to the nature of technology development, new devices, programs, and

strategies will be developing at an accelerated pace, and this will lead to more options for research in this field. I also question if the current trend towards technology research can keep up with the current development of new tools. This connects to the second research questions, what is the intensity of each study. Studies reviewed were mostly explorative in nature. Studies were limited due to constraints on participants in areas of sample size and convenience sampling. This causes the reliability of their conclusions to be called into question under the chance that results were unique to the study group and not transferable to the education field. It will be up to educators to seek the training they need to incorporate the devices, digital tools, and strategies discussed in this essay.

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