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A Study on The Positives and Negatives of Using Technology In The Classroom

An Honors Program Thesis

by

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Spring, 2017

Department of Education

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A Study on the Positives and Negatives of Using Technology in The Classroom

Abstract

As the growth of technology application in the classroom continues to grow, educators and researchers speculate as to how effective the use of assistive technology, and educational technology aids are. Over time, several researchers have done studies, and conducted observations on technological aids and devices being used in the classroom. Some results were measurable, and others observable, but mixed results were found. This study explores the different research conducted on the subject, and several of the factors that contribute to the use of, and success of technology in the classroom. Of the research examined, most of the responses were positive, supporting the idea that incorporating technology into the classroom is beneficial for both the students and the teachers. However, with the concerns expressed by teachers, the success of technology in school settings is dependent on the self-efficacy and professional development, or training, that the teachers receive. Using a) changes made to the Federal and state government policy on education, b) examples of implementation of technology in the classroom, both positive, negative and questionable, c) the use of technology with diverse groups of students, d) the perceptions of students, teachers/school staff, and parents, and e) research on the self-efficacy and professional development and technology training of teachers, this study concluded that the use of technological devices, programs and aids in the classroom should improve students' assessment performance, level of engagement, and academic success. However, these results depend directly on the self-efficacy, and continuous training of classroom teachers.

Introduction

Throughout much of the twenty-first century, technology has advanced astronomically, from the introduction of the computer in the late seventies to today, where we use touch screen monitors and talk to our devices on a daily basis. Technology is not only being used on a personal level, more often than not technology is being used in a professional manner, changing our medical field's scientific research, and the way in which children are educated. Since the implementation of the No Child Left Behind Act in 2002, and, more recently, The Every Student Succeeds Act of 2015, schools have changed the way they teach from the more "traditional" teacher-centered approach to a technological, hands on environment. Researchers hoped that these changes would improve student engagement and draw more relatable connections between the information provided to and understood by students, thus improving their educational experience. However, as with any other major change, not everyone has received this as a positive message. Some believe that the use of computer technology in the classroom is distracting, and even undermines, the teacher.

To explore this topic from both sides of the argument, research was conducted on New York State education policy and standards; the ways in which technology may be implemented in the classroom, and how it is implemented with different groups of students. The researcher explored both positive and negative applications of technology. The writer also investigated technology use, student, parent and teacher perceptions, and the specific effects of a teacher's level of self-efficacy while handling these devices. The researcher reviewed peer reviewed

journals, academic articles, and a few articles with strong content from some creditable, but less academic, sources. Using this material, the researcher questioned whether or not the use of technology in the classroom is beneficial with the intent of weighing the positives and negatives to reach a conclusion supported by the collected data.

The State and Federal Government's Role in Education

Obama recently reauthorized and revamped the Elementary and Secondary Education Act, also known as the No Child Left Behind Act of 2002. In December of 2015, Congress passed the Every Student Succeeds Act as a response to the long time issues associated with State mandated academic testing. The authors of the ESSA also re-evaluated and changed some of the policy originally associated with the NCLB (2002). Since the NCLB policy, ESSA states no longer focused on the spending and budget process as their main priority as they had under ESEA. Instead, they were to focus on the accountability of teachers and on the academic success of their students from school to school. According to an article by Gross and Hill (2016), this change also initiated the idea of collecting and monitoring data from students in each school from standardized exams. In the schools where all students, or a minimum of 20 students were not performing up to the standards set by the state, the school would be placed on a list known as the "needs improvement" list, and work would be done to correct the issues.

However, some more recent changes made to the policy in 2015, included removing the responsibility of improving school test scores from each school, and placing it back on the state

government. Additionally, the new Act changed the way teachers are evaluated, and changed the curriculum standards, as well as adding the idea of “Race to the Top”, which was implemented with the idea of motivating innovation and reform in K-12 education. With that, there are a few things that New York State educators can expect to see remain from the No Child Left Behind Act of 2002. For example, students will still be required to take state tests in grades 3 through 8, however, the results of these tests will be analyzed differently, putting less pressure on teachers. While the education establishment sees these changes as positives for teachers, school staff, and administration, it does require the state to face new challenges.

From the perception of the educator, and from school administration, these changes represent new horizons as far as how curricula are designed, lessons taught, and improvements strategized. According to an article by Fennell (2016), these changes represent a new opportunity for school staff involvement and career advancement, allowing teachers to branch outside of their normal day-to-day activities and into administrative work without having to leave the classroom. The Every Student Succeeds Act (ESSA) now requires schools to consult with their stakeholders before moving forward with the implementation of new district policies. Until recently, stakeholders did not include teaching staff, IT support staff, and other school-wide positions.

In addition to changes being made through the ESSA, the National Education Technology Plan of 2010 has set out changes and goals to improve school education through technological advancement. According to articles by Kenefick and Werner (2012) and Harold (2016), the United States Department of Education issued the National Education Technology Plan with the intent of closing the gap between the digital use divide, that is, schools using digital technology

and those that do not. It has been found that when students are able to make connections between the content in front of them and the world in which they live, what is now being called active-technology, they are more likely to experience success with “real world” problem solving outside of their school careers. This idea is in response to the minimal improvements found in response to passive-technology, that is, that students are handed a device, and spend class time “staring at screens”. The goal of any educator is to provide their students with the opportunity to succeed. However, it is unrealistic to think that every teacher can fully take advantage of the technology in front of them during every lesson, every day. Teachers will likely not be able to include proper coding and decoding, simulation, design and multimedia products in each of their lessons. The idea is that incorporating these principles throughout the day, even in small ways, promotes progress. There are many ideas on how to do this, one of which was issued in The National Education Plan. It is known as *Transforming American Education: Learning Powered by Technology* (2010). The five most effective ways to integrate technology into essential content areas in an educational setting are outlined in this document. These five suggestions include keeping education engaging, using assessment, preparing educators, building a comprehensive infrastructure, and improving productivity.

In order to effectively reach the goals of each of the five principles, researchers have found that it is necessary to take education out of the classroom, extending the experience past the traditional walls of the school, by providing technological access to all students. By providing devices to all students, teachers will be able to increase engagement and involvement. Students, with access to their own individual devices equipped with educational software, will have the opportunity to monitor and participate in their own learning, therefore becoming more

creative and knowledgeable. Researchers believe this will better prepare them for a successful life in today's society. Technology has also been found to help monitor progress and make for more improvement among students. By using technology to assess student progress, educators are able to better measure what really counts, that is, the students' overall achievement and understanding. Using technology, the data collected can be further analyzed, and done so on a continuous basis, making it more valid and more reliable, and helping teachers better modify instruction when necessary. According to this report, schools should be careful to maintain the privacy of the of individual students' reports, while also sharing the information necessary for improvement.

This study also reported that educators will be able to better connect content to real life experience through the use of technology. By using technology, there can be constant access to the newest and most advanced resources, and access to updated data content and research expertise. It is believed that having access to all of these resources will improve the learning experience of the teachers, which will encourage them to do the same for their students. It will also encourage teachers to practice a more effective approach to educate all of their students, even those who require diverse thinking and instruction. Overall, it is believed that if teachers have access to interesting, engaging, and up to date information, they will be better able to create models and demonstrations that will foster a connection between content and life. In addition to motivating educators to improve their own performance, this report found that technology will also allow for a more comprehensive and easily accessible infrastructure for both the teachers and their students.

Having a means to follow and track educational performance is important for all parties involved. Having access to one that is clear and continuously updated, anywhere, at any time, through open access stands to improve educational experience and performance. Finally, the authors of this report found that there were benefits to using technology in terms of productivity. Technological assistance means that grade keeping, tracking, and reaching learning outcomes will be easier and more accessible. As a result, schools will be better able to utilize their staff, optimize time management, and more efficiently spend and use their fiscal resources. As a whole, the authors found that with the use of technology, schools and the State as a whole, will be able to improve their use of time and money, improve teacher motivation, and classroom engagement, and improve the performance of students.

Classroom Implementation

Because New York State has accepted, and encourages, the use of technology in the classroom, teachers and administrators question what to use and how exactly to use it. Considering that technology has, and continues to evolve, there is a developing age gap in the use of and comfortability with technology. To help minimize this gap, the New York State Education Department has issued a “digital literacy” program. The hope is to provide teachers with a means to use a wide range of devices in an effective way to collaborate within the classroom, create lesson plans, and conduct research.

According to research done by Dotterer, Hedges and Parker (2016), New York State’s plan is to bridge the growing gap between the “digital natives,” students, and the “digital

immigrants,” educators. Because much of today’s educational experience occurs on a “virtual basis,” with, according to Selwyn and Facer (2014), little of the classroom material remaining untouched by technology, the New York State Education department is following their own example, and has purchased iPads. Over 60% of those purchased are paid for by the state. Their plan, called the iPad one-to-one plan, according to research by Gentile (2012), is to “replace backpacks and textbooks with iPads.” Going further, the author estimated that within the next 5 years, iPads will outnumber computers in most public schools.

This idea is made even more relevant by the fact that teachers all across the United States are finding it necessary to be able to access data and information through, and related to mobile devices, such as, tablets and iPads. Also noted in the article, were the different ways that instructors may find the use of tablet devices helpful. According to the information provided, the use of tablets and iPads aid teachers in their ability to share and record data with students, faculty and administrators more directly and quickly. Using these devices allowed teachers to share selected information with any number of coordinating devices, meaning those paired or registered to the same system, according to specific characteristics, such as, class, grade list, or educational curricula.

In addition to assisting teachers and staff using these devices, students will have the opportunity to use digital textbooks, allowing them access to multimedia features, such as those found in the study of Zhong and Yuzhen (2015). During this study, researchers found that digital textbooks generated access to new resources, such as, interactive controls, e-annotations, and an ability to track learning processes independently. These resources, thanks to the use of mobile devices, such as laptops and tablets, could make the academic experience easier because they are

more flexible and accessible than the traditional “paper-based” forms of material. The research in the survey revealed that, as with teachers, the students’ perceived self-efficacy, had a direct impact on whether or not technology, like digital textbooks, would be used, and to what extent. To measure the level to which digital textbooks would be used, researchers relied on the Technology Acceptance Model (TAM) used by Davis from 1989-1993. Taking into account all of the information stated, the authors implemented a 70 item, online survey/questionnaire. The questionnaire was posted, and then downloaded for interpretation. The results helped school officials and policy makers implement technology, and digital textbooks more effectively and appropriately for all students.

Several schools have extended their device initiatives beyond computers and tablets. Some schools have opted to allow students to use their own mobile devices in the classroom. Called the Bring Your Own Device initiative, or BYOD, this new system incorporates mobile devices, such as smartphones, as part of the academic process. Using software and predictors, such as the home mobile technology index, the school’s overall rating, and the school’s technology rating, Kiger (2015) found that the use of these devices will have great benefits to the schools using them, including an increase in the use of online resources and improved access to the internet and its tools. Another fast growing item used in schools are Smart, and Smart white boards. Smart boards use a program that makes them useful in a way that provides each student access to the same information, at the same time, by following the teacher’s lead. The interactive, computer based board doubles as a white board, with the ability to project content, and display videos, clips, and animations.

These boards, paired with another popular device, the document camera, or visual presenter, can improve the educational experience for all involved. For example, Pascopella (2009) found that students are more engaged and are more likely to be involved during class discussions, allowing them to gain deeper understanding of concepts taught. This study also found that the use of these devices will improve the experience of classroom teachers as well. Martin, Shaw and Daughenbaugh (2014) said further that there was more engagement when manipulatives were added.

Because technology continues to advance, and there are so many different devices and tools, researchers place strong importance on the necessity of familiarity with the actual use of devices. Lavonen, Autio, and Meisalo (2004) said that the use of a device is not the most prevalent aspect of utilizing technology effectively. Instead, the true importance lies in using these devices in such a way that promotes creative problem solving. From the Creative Technology Education Project (CTEP), the researchers found that students experienced 4 different “key factors” during the creative problem solving process. Students identify specific problems, generate alternatives, appreciate others’ ideas, and give positive feedback. The researchers also found that students felt as though they were not learning enough to generate their own good ideas. By using technology effectively, students will be better able to do so. A similar study, by Ucak and Bag (2012), focused on the self-efficacy of students when using technological devices, specifically in science classrooms.

By the end of this study, researchers found that there are a few correlating factors that determine a student’s ability to use technology effectively. According to the results, there is a connection between the students’ grade level and the level at which they feel comfortable using

technology. There was also a connection found between the education level of parents and the self-efficacy of students. Because of these results, we know that there is an appropriate manner to teach students using technology, depending on their grade level, and the apparent education level of their parents. Taking all of this information into account, data found in a study by Kirakidis and Johnson (2015) can be applied, with suggestions for a solution. In order to maintain that all students are on, or close to the same level, and receive the best education with technology as possible, researchers found that students best received information when they are taught in small groups, one at a time. This is particularly important in the public school system. Because no two students are exactly alike, and may not all come from the same cultural and financial backgrounds, it is important to allow them access to the same technological education.

Because it is so important that the technology that is used in the classroom is appropriate and effective for all students, some researchers have set out to explore the most effective devices being used, and the best ways to use them. According to Willis, Ketsell, Grainger and Missingham (2013), e-L&T aids, the different devices used to assist the classroom teacher, vary in the amount of time used, and the degree of use. Research was conducted on 21 teachers, via a survey, during which time the instructors were asked for the perceptions on the following technological aids: lecture recordings, screen-casting, podcasting, audience response systems, side annotations and documents camera. In addition to their perceptions, instructors were asked to respond to the possible/observable impacts of each of these devices. By the end of the survey, the authors discovered that several of the devices made available to instructors, were not, or were hardly ever used.

As seen in Table 1 below, the technological aids most frequently used were lecture recordings, with a total of 66.7% use, and the lowest was the audience response system with only a 4.8% use. In addition to these figures, the survey also revealed that teachers have generally positive responses to the use of technology during instruction, although, they did report some reservations. According to research, some instructors fear that assistive devices and aids actually make planning instruction on a daily basis more difficult, requiring them to spend more time working on lessons and researching how to integrate the technology effectively.

	Very Bad	Bad	Neutral	Good	Very Good	Total
Lecture Recording	4.8%	4.8%	4.8%	19.0%	33.3%	66.7%
Screencasting	-	-	-	14.3%	33.3%	47.6%
Podcasting	-	4.8%	-	4.8%	23.8%	33.4%
Audience Response System	-	-	-	4.8%	-	4.8%
Side Annotation	-	-	-	9.5%	-	9.5%
Document Camera	-	-	-	42.9%	19.0%	61.9%

Table 1: Academic Perceptions of e-L&T Aids (Willis, Ketsell, Grainger, and Missingham (2013))

To aid in providing solutions to these issues mentioned by the instructors, the authors posited four ways to make the integration of technology easier and more effective. According to the article, the instructors should maintain knowledge of their class/audience, manage the amount of work to be completed, keep students actively engaged, and monitor the effectiveness of the activities on a continuous basis in this way, they should be able to use aids and assistive

technology more effectively and so that it is less of a burden to them. This would make the instructors more likely to use the technology, and provide a better academic experience for the students.

Implementing Technology in the Classroom with Diverse Types of Students

Students with Special Needs and Disabilities:

Special education policy makers, educators, and administrators have been, and continue to be, devoted to the success of students with special needs and disabilities. Whether by means of augmentation, bypass, or compensation, the intended outcome has always been that students overcome their challenges and succeed academically. According to articles by Edyburn (2013) and by Kellems, Grigal, Unger, Simmons, Bauder and Williams (2015), one approach to meeting this goal is through the use of technology and technological software/programs in the classroom. According to these articles, the effects of using technology in the classroom are both observable and measurable. Upon review, researchers found advancements are apparent during the teaching process while observing the students and their progress, and afterwards, when reviewing student test scores.

According to the Technology-Related Assistance for Individuals with Disabilities Act (1994), there is a difference between assistive technology devices and assistive technology services. Assistive technology devices are those pieces of equipment that are used to improve, or at least maintain, the functions and abilities of students with disabilities. Assistive technology

services are the help provided to students with special needs, that allow them to select and use these devices. In order to provide these devices for this assistance, students must be evaluated for their existing function, the results of which must be used to determine which device, or devices, would be the most appropriate and the most effective. Students with special needs should also receive assistance for purchasing or borrowing these devices, and of course, be trained in the correct handling, use, and available applications of these devices. Students are not the only ones who need to receive training with these devices. According to an article by Edyburn (2013), teachers and the student's professionals and assistants, must also receive training, to ensure that the student is getting as much out of using it as possible.

In an academic setting, the use of technology is known as instructional technology, or educational technology. The focus is on the use of technology and assistive devices throughout the day in the application of teaching and learning, both by the students and the teachers, to improve academic success. Approaching this goal academically, special education teachers describe improvements as looking through a kaleidoscope. From a technological standpoint, special education teachers must teach using a "multi lens" approach; considering theory, innovation, and policy, all at the same time. According to research by Edyburn (2013), using the multi-lens approach allows educators to utilize the ideas of augmentation, bypass, and compensation to better assist their students. The idea of augmented instruction, or augmented learning, is that the environment is adjusted to better suit struggling students, and not the other way around. In other words when designing curricula, program designers and classroom teachers should consider diverse types of students, and structure lessons accordingly, to make the academic process more easily successful for these learners. In order to do this, educators must

consider several things prior to moving forward: the importance of moving classroom instruction and goals away from memorization of facts and definitions, keeping instruction short, to the point and engaging, and using real-life examples. In addition, teachers must also recognize the importance of on demand, or right now learning, which means that students do not learn material prior to using it in class. In other words, the students do not learn a concept one day, or for homework, and then receive examples and/or applications on the following day(s). Everything should be done at once to help students maximize their understanding.

The idea of “bypassing” in the classroom and in the instructional process is that some students, whether with or without disabilities or special needs, struggle with ideas and subjects, and these students should be provided with the extra help they need to achieve success. To “bypass”, in this situation, means to provide these struggling learners with trained, and qualified teachers, who will be able to assess their needs, and move forward with instruction, yo re-engage the students and to help them better understand the material(s) with which they are challenged. The idea of “compensation” in the classroom, and in extra help settings, is one that is and has been, frequently used. Often applied to students who have special needs or disabilities, compensation means to provide tools and assistance that make up for what the student is lacking to help them work toward academic success.

According to Edyburn, teaching in this way allows educators to filter through, view, and research new information on instruction using technology, therefore improving the educational material and resources available for students. In addition to improving students’ classroom education, technology use in the classroom has been found to improve the “real life” preparation of special education students. A smooth transition to adult life during the 21st century is a very

important part of classroom instruction for students with disabilities and special needs. Through the use of devices, such as, laptops, touch pads/tablets, and smartphones, special education students have access to new programs that offer assistance in areas such as choice/decision making, self-management, employment, and recreational activities.

Edyburn (2013), found that if assistive technology was used, the following outcomes could be anticipated: 1) technological devices and programs would decrease in cost, allowing all students to use and be fluent in the use of multiple devices per day, 2) each of them having their own personal access to assistive technology and devices, and 3) the devices would serve as a functional assistant to each and every student. Curricula is also anticipate to be changed and improved. According to the article, with the digitalization of the curricula, students will no longer have to wait for accommodations and modifications to be made to material included in their school's curriculum. Instead, they will have the tools available to them to make changes in real time, changing the information in a means, or format, that is appropriate for them, and meets all their needs as learners.

Finally, there are positive changes that can also be expected in the area of academic and progress data. As technology becomes more and more important to classroom teaching, and school buildings as a whole, parents teachers, students and administrators will find it easier to access student progress information online, from home. Edyburn speculates that this tool, in conjunction with adaptable curricula, could eliminate the need for IEPs and 504 Plans, as each student would essentially, be provided with his own personal curriculum, as well as the tools that match the students' needs.

According to research by Kellems, Grigal, Unger, Simmons, Bauder and Williams (2015), technological devices now provide these students with assistance for communication, responses, response time, social relationships, and employment. Furthermore, these devices also provide students with post-secondary training in specific content areas, as well as access to virtual learning experiences. Even more than their academic education, the use of technological programs and software in the classroom provide students with access to information they may rely on daily, such as, public transportation schedules. To meet these advancement goals, students have devices for activities in response prompting, video modeling and prompting, virtual experiences, virtual job shadowing, and as a transportation aid (example: GPS).

Response prompting is the use of technological devices and strategies to improve and enhance the chances that individuals will engage in socially acceptable behavior. Commonly used by special education teachers, response prompting is most often used in three ways: as modeling, as verbal instructions and as physical guidance. As noted in the article, thanks to the advancements of technology, the ways in which these instructions can be delivered has changed and improved. With the growth of classroom and individual use of technology, response promoting can now be done virtually through video modeling and video prompting. Video modeling is composed of someone completing a task or behaving appropriately in social situations, which is made into an instructional video that can be watched by individuals with special needs. These aids are most frequently used to teach students vocational and technical life skills; allowing them to develop individual and independent living skills successfully.

Video prompting is a specific form of video modeling. It is used generally for multi-step tasks or instruction. Long and involved, multi-step tasks are broken down into clips, or segments,

that individuals watch one at a time. Students are then prompted to complete each step as they finish the video. This allows students with special needs to learn how to complete each individual task that goes into a specific training. It ensures that they understand the skill as a whole and better enables them to complete the task correctly.

In addition to helping develop the skills of special needs individuals through video modeling and prompting, technology also allows students to experience different “real-world” situations and careers. Through virtual experience(s), students can now walk through different situations they may encounter while living on their own, and see how to deal with and solve potential problems. In a controlled, safe, and productive environment, students can learn problem solving skills and apply them to their own lives. In addition to this, the idea of virtual reality also opens new doors to how careers and jobs are selected for individuals with disabilities. Using online websites and databases, students can now log on to different web addresses, in a safe and controlled way, and browse through different potential careers. Each career choice provides a short summary of what the job title means, what the job includes, and how the employee’s time will be spent. Also included with these jobs are video simulations that allow the students to observe someone completing the tasks associated with different career choices. This helps them better choose paths for themselves- by knowing exactly what is involved in each job, thus improving their chances for success. For convenience, these jobs are accessible, most of the time, in four different ways: 1) by career and career cluster, meaning by the specific occupation industry, 2) by skill and skill ability, meaning by the traits necessary to complete each occupation, 3) by industry alone, and 4) by work options, such as, how extensive the training is, degree requirement(s), etc.

The virtual reality world has also opened the opportunity for individuals to follow, or shadow, trained professionals in different fields. Virtual job shadowing is the recording, or live streaming, of daily tasks associated with different careers, which is provided by trained professionals in that field. This makes the recorded experience a live one, and allows individuals the ability to interact with possible co-workers, representatives, and leaders so as to gain a deeper, more applicable understanding of the job, its requirements, and the overall experience.

More than just providing special needs individuals with the opportunity to choose and appropriate career path, the integration of technology into skills classes also helps students to develop skills they will need for day to day success, such as getting from one place to another on their own. Thank to technology, transportation services are available to everyone, making commutes easier and safer. One example of the transportation services available as a result of the growing use of technology is GPS, or global positioning software. GPS are handheld, interactive devices used by the general population as a whole for assistance in navigation. Using these devices, students can receive auditory and visual cues instructing them on where to go and how to get there in the most time and cost efficient manner. Since most of these devices provide navigation assistance for any means of transportation, for example by car, bus or walking, anyone can use them for help, making the lives of all people, but especially those with special needs, a little easier. All of these advancements allow students the opportunity to be more self-sufficient, with a better chance of successfully living independently in the 21st century world.

When looking at the effects of technology in the classroom on students with learning disabilities, it is important to remember that these students have different strengths and weaknesses than other general education students. The goal of special education, to help students

succeed independently academically and socially, has resulted in an increase in the number of technological devices in classes. Because of this, researchers have asked the question: What approaches are better for students, app-based instruction, teacher-directed instruction, or a combination of both? In an attempt to answer this question, an article by Bryant (2015) followed six special education students who have a large amount of time being taught with each of these methods. By the end of the study, no conclusive results were found. However, during one-on-one interviews, at least one student favored one instructional method over the others. As a result, Bryant determined that the most appropriate way to ensure an appropriate and effective education for all special education students, while also using technology in the classroom, was to use a combined approach. A combined instructional approach means that students spend a fair amount of time using computer/tablet devices, and the accompanying applications on their own for exploratory learning, as well as a fair amount of time being taught by the classroom teacher using technological devices with the class as a whole. In short, teachers should alternate instruction between technology mediated instruction and teacher mediated instruction.

According to an article by Bouck (2015), technology and computer literacy programs have proven very helpful when working with students who have learning disabilities, specifically while working to improve their writing process skills. In addition to helping students' writing skills, the researcher found these computer literacy programs to be helpful since they are pre-existing and many are free. This makes it easier for classroom teachers to provide access to them within their classrooms, assuming that there is enough computer/device access for the class.

Students who are Culturally Diverse and English Language Learners:

In addition to being helpful to students who have learning disabilities, the use of technology in the classroom has also improved the educational experience of students who are English language learners (ELLs), as large gaps in performance continue to grow between English speaking and non-English speaking students. In an article by Abedi (2014) on standardized tests, ELL students scored 40-60% lower than their English speaking peers. Many different accommodations were used to try and lower these figures, like dual language versions of tests, bilingual dictionaries, English dictionaries, and bilingual glossaries.

Providing students with dual language versions of tests involves presenting exam takers with two versions of the same test, side by side, one in English and one written in their native language. The students will have an aid to assist them in the exam process, which is often an audio file with translated question and answer choices. The results of this accommodation have been mixed as far as effectiveness. Bilingual dictionaries can be helpful for ELL students, however, they are typically marketed toward conversational language translation, and as a result, may have less academic language available than what the students need. For this reason, the use of bilingual dictionaries was found ineffective. The same was found to be true for English dictionaries. While they do contain more academic language, these aids present the issue of having to be provided to each student participating in the exam, which is costly, excessive in

size, and not always a familiar resource for the student test-takers. These factors have shown to increase the level of student discomfort and discouragement, and, therefore are not an effective test accommodation.

Bilingual glossaries are another accommodation that has been tried with ELL students. According to the article, a customized glossary provides English terms, with available translations into the students' home language(s). Statistics on the results of this accommodation showed that the students who received the assistance did, in fact, score higher on their exams, however, not at any real significant level. Computer based literacy programs have proven valuable in the observation and evaluation of ELLs in elementary and secondary classroom settings, offering many more accommodations than made previously available by the traditional "pencil and paper assessment" and assessment aids listed above. The most successful example cited in the article is the accommodation provided by the use of computer programming, in conjunction with some of the aids listed above (i.e. bilingual dictionaries, pop-up glossaries, read-aloud options, etc.) The use of the computer with these accommodations is effective because it provides the students with the help they need to be on the same level as their peers, in an accessible, user-friendly manner. However, it does not give them any further information than the translation of questions and/or responses, meaning the thought process and answer still rely on the students' use of classroom information and knowledge. Examples of these accommodations, pop-up glossary, customized English dictionary, extra test time, and small group testing are within exam programs created by The National Center for Research on Evaluation, Standards and Student Testing (CRESST). This proved to be the most successful approach to making exams more accessible to ELL students.

Students who are Homeless or Living in Poverty:

Articles by Rahman, Turner and Elbedour (2015) and Reddy, Kettler and Kurz (2015) show that the use of technology in schools is also beneficial to students who are living in poverty or who are homeless; a population of public school students whose number is continuing to grow. According to Reddy, Kettler and Kurz (2015), it is the classroom teachers' responsibility to provide an appropriate and beneficial education to all of their students; while working within the economic standards of the school and the community, by relying on the interdisciplinary collaboration of school systems. Classroom instructors and school officials must model and teach students unique skills that nurture effective leadership qualities and encourage students to succeed.

Observers found that this is made easier with the use of class-wide multi-media tools, providing access to students who may not have technological devices at home. According to Rahman, Turner and Elbedour (2015), it is important that teachers and schools make technology accessible for all students. It must include those who are living in poverty or who are reported as homeless, as this population does show the ability to succeed in school and continue on to higher education, although they need extra help. According to the research in this article, schools should aim to improve the availability of research methods, materials, computers, and software to this population of students. Doing so will improve their educational experience and their likelihood

of success within their primary/secondary school career, as well as in their career in higher education.

Positive Uses of Technology in The Classroom

Various studies completed over the last several years have proven that the integration of an interactive learning network (ILN), or the use of technology by both the classroom teacher and students, will improve the students' academic performance overall. As discussed in an article by Enriquez (2010), studies have proved not only the benefits of using technology in the classroom, but have also proven the ineffectiveness of what is considered the "traditional" teacher centered classroom setting. For the students, the ILN has improved performance in areas like quiz grades, homework completion, and student engagement, which is demonstrated by Table 2 below. Homework represents fifteen assignments, and Test Average represents a total of four exams. In addition to the listed assessment increases, the use of ILN in the classroom has shown to improve students' performance level, information retention, student engagement, and maintain a student's positive attitude toward using technology throughout the day. Additionally, the use of an ILN is useful to the instructors as well, allowing them to more quickly deliver content, access completed homework assignments, and monitor progress in real time.

Experimental Spring 2006 (ILN)	Comparison Spring 2005(non-ILN)	Difference N=41	Categories N=28
Quiz Average (out of 5)	4.7	3.4	1.3*
Homework Average (out of 10)	9.3	8.6	0.7*
Test Average (out of 4)	76.6	70.8	6.2
Final Exam (out of 100) 5.6	83.4	77.8	5.6

Table 2: Enhancing Student Performance (Enriquez, 2010)

All of these allowances provide teachers the opportunity to work with students in their specific area of need, without requiring them to be in the same room as the student. In addition to ILNs, the idea of a flipped classroom is also effective in improving classroom experience. The concept of a flipped classroom, which incorporates both behaviorist and constructivist theories, is the idea that it is the students' responsibility to complete any and all reading and research work for homework, prior to class instruction. Using technological devices and online programs, the flipped classroom, according to Hawks (2010) will make it easier for teachers to make "real life" connections to the content, encouraging students to think more critically, and gain a deeper understanding of the material. According to the article, taking the classroom from a traditionally structured, lecture class to a flipped classroom environment, makes learning "active", and therefore more effective. By requiring the students to do their own investigative research and reason abstractly in regard to the topics being discussed, the flipped classroom fosters the skills students will need to solve problems in and out of the classroom. In addition, a flipped classroom

setting encourages students to work together, maintains active engagement, and dramatically increases knowledge retention.

According to an article by Noo Noo (2014), ILNs and flipped classrooms are made more successful and are more easily attained by using tablets. Tablet computers and iPads allow teachers to utilize apps and software to assist in changing their instructional method; helping them to move away from the lecture centered classroom that they might have been using previously. As mentioned in the article, several classroom teachers have initiated the use of tablet devices in their classes. Instructors mentioned using 1-1 devices, iPads, SmartEdPads, and iPads with small groups of students. Classrooms in which 1-1 tablet devices are found may use cloud collaboration tools, such as Google Drive, to assign, grade and share documents among all or a selection of students, allowing students to spend more time on their own work, and assist classmates on projects, freeing up time and providing the opportunity to create, and foster deeper learning experiences. Other teachers have used the tablets to convert their traditional “pen and paper” classrooms to 100% paperless ones; using the tablet devices to assign, view, and grade homework assignments, which allows the teacher to mark and return grades to students immediately via programs like Microsoft OneNote. Programs like this allow classroom teachers the opportunity to track their students’ progress without high-stakes assessments. Other instructors have used their classroom set of tablets to flip their classrooms, changing the environment and dynamic of the academic process completely, by putting the students in control of their own progress and learning; allowing them to become more autonomous.

According to Noo Noo (2014), using a mix of iPad tablets and SmartEdPads enable teachers to explore new educational opportunities as well. Working specifically with small

groups of students at a time, the collaboration of both of these devices has allowed classroom instructors to personalize instruction for all of these different groups in ways that was not previously possible when time with students is short and split up throughout the day. The SmartEdPad allows special education students to use and explore over 150 carefully designed applications, and each device has the capability to be customized to different students' individual needs. When it comes to using a limited number of iPad tablets with a whole class, instructors included in the article report that it is all about "strategic use" (p.13). This strategy is particularly useful when working with ELL students, who use sight-word apps. The iPad represents story details visually, allowing students to comprehend the material and present it to one another, express their ideas, and deepen their understanding through the explanations of their classmates.

Questionable Uses of Technology in The Classroom

It is clear that the use of technology in the classroom improves the level of engagement of students; however, it is less clear whether or not there is a measurable improvement in literacy development. According to Walsh and Simpson (2014), following studies conducted, it was "difficult to put into words the richness observed" when students used individual devices, and the smartboard within their class, meaning that it was difficult to measure via test results, but observable in the classroom. The results of that study found that the use of technology improved literacy development significantly.

In addition to research being conducted on the effects of technology on student literacy and development, there is also a need for research on the effects on student performance. Research conducted by Union, Union and Green (2015), found that technology contributed to an improvement in student performance. However, this conclusion is taking into account certain specific considerations, such as, research found in classes grades K-5. By distributing Kindle E-Readers and Nooks to students, researchers were able to measure the performance of students over a two-year span. Using the results, researchers found technology to be beneficial when taught by knowledgeable instructors, with supportive parents at home, and when integrated into everyday lessons.

As mentioned in the article, “the twenty-first century classroom is heavily influenced by the use of information technology” (p. 71), most likely as a result of the students born within this time being so familiar and well versed in their use. These devices have proven to be very useful and beneficial for students, helping to make them better problem solvers, more critical thinkers, more creative, innovative and social, and improving their information literacy skills. Examining elementary schools, and students in grade K-5 specifically, the use of portable technology devices, like iPads and Kindles, have significantly improved student performance on reading and ELA exams, as demonstrated by the line charts below in Table 3 and Table 4, by allowing students the ability to easily download material directly to their screens. As a result, students are more engaged and more involved in their own reading process; advancements that improve reading comprehension skills, vocabulary skills, and students’ levels of achievement.

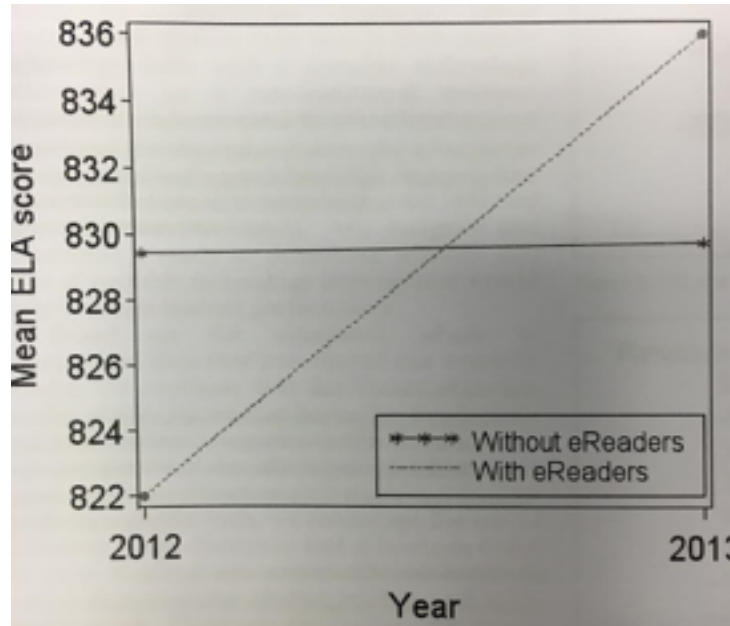


Table 3: Plot of Mean Reading Scores in 2012 and 2013 differentiated by e-reader use (Union & Union, 2015)

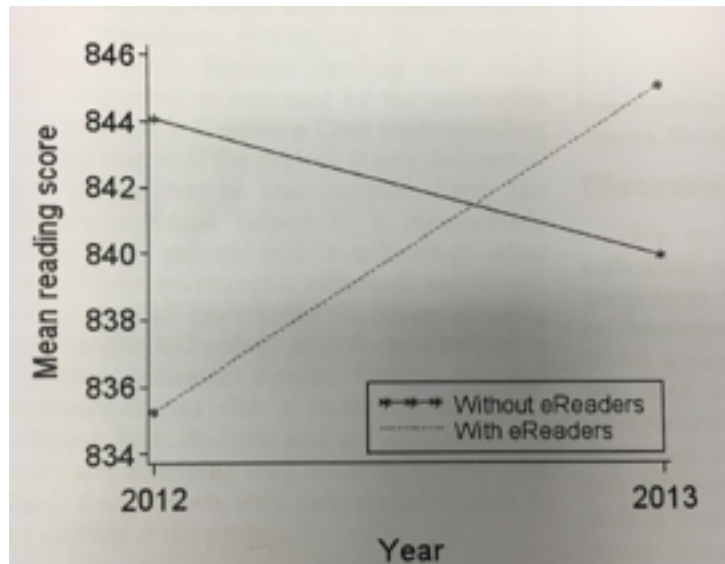


Table 4: Plot of Mean ELA Scores in 2012 and 2013, Differentiated by e-reader usage (Union & Union, 2015)

Research also found that the use of devices, like iPads, was positive in the education of special needs students. According to Ok and Bryant (2016), fifth grade students who received explicit and strategic instruction using iPads experienced improved differentiation of classroom

instruction. In order to arrive at this result, students were pre-tested, monitored daily and formally tested to show individual growth associated with the intervention. Using math, and multiplication as a basis for the study, researchers found that students were better able to retrieve facts automatically, and use more advanced problem solving techniques after the intervention using the iPad.

Because technology is increasingly used in classrooms, the need for monitoring and assessment of use has increased as well. One way that the use of technology can be monitored, according to Parette, Blum and Boeckmann (2009), is the concurrent time series probe approach. This method involves the observation and monitoring of students and their progress. This approach requires that students be observed when using and not using technological devices, so that a performance level may be established for comparison purposes. By the end of the study, a positive correlation was found between the use of assistive devices and student performance, reinforcing the idea that technology is, in fact, beneficial to students and their academic experience. Van der Meih and Boersma (2002) assessed the level of improvement made to students' education by using technology. During this study, students were asked to use computers to email students at other schools. Within these emails, researchers looked for patterns on stacking, compounding and what is called "just in time" patterns- each representing a different level of self-efficacy when using the email and the device. By the end of the study, researchers found that students all possessed some level of ability to use the device and email. However, it was also found that the level of ability was directly associated with the amount of time spent practicing. From this, researchers concluded that students should spend time using technology within their classes, to improve their level of self-efficacy, and therefore increase their ability.

In addition to using tablets, iPads, and computer devices, positive uses of technology can also be seen when using interactive white boards (IWB). In a study by Ipek and Sozcu (2016), the use of interactive white boards in classrooms allows for teachers to make modifications to new and pre-existing lessons, and to add notes and insert multimedia clips to be observed by the class as a whole. As a result of all of these new advancements, there has been an improvement in the level of student literacy when dealing with visual and media knowledge (readability, computers, and digitalization). In an article by Chuang and Rossenbusch (2005), which used teacher interviews, recorded presentations, and student evaluations, researchers observed the effects of video technology, meaning video recording devices and media clips, in the classroom. As a result, it was found that when teachers are properly trained, and that training is conducted continuously, students do, in fact, benefit from the use of video technology in the classroom-making class content more motivating and engaging.

Negative Uses of Technology in The Classroom

Classroom technology, and its collaborative learning tools, are increasingly supported by schools and often implemented in everyday class lessons. However, the technology is not always used appropriately or effectively. According to YunJeong, Chang, and Hannafin (2015), classroom teachers often, unfortunately, do not effectively incorporate technology into their pre-existing lessons; meaning that, they briefly use the devices in new lessons where they are able. In fact, teachers have not made much effort to re-create the lessons they already use, and have used

in the past. In addition to the ineffective incorporation of technological devices in classes, an article by Padron (2012) studied the use of technology in classrooms as an enrichment tool, specifically for ELL students, by means of observational research.

Using the Classroom Observation Measure (COM), researchers measured the extent to which classroom teachers made use of the technological supports and devices made available to them in relation to a) classroom organization, b) classroom activity, c) role of the teacher, d) strategies used by the teacher, e) evaluation strategies, and f) the quality of the lesson being taught. Following the observation of 27 classrooms, observers measured the use of technology by marking them with either “none,” “some,” or “extensive.” The researcher found as a result that although several schools are more than equipped to provide teachers and students access to assistive and collaborative devices, the devices are not being used. Following the goals set by The No Child Left Behind Act of 2001, schools provided teachers and staff with professional development opportunities to become more familiar with, and better prepared to use, devices within their lessons. The goal is that by eighth grade, every student will “be literate in the use of technology,” and they will achieve a “mastery level” of the use of material to help them nurture their reasoning and their problem solving skills and strategies. However, by the conclusion of this study, it was found that, overall, teachers were not making use of the devices available to them, students were not being challenged by classroom material, and students were not being encouraged to practice and use collaborative and assistive devices on their own.

Because of these reasons, a gap in what is now being called “the digital revolution,” that is, today’s education system, is becoming more and more apparent. According to Gomez (2016), this gap is developing as the demands associated with the use of technological devices in the

classroom grows, and the level of comfort with and the use of devices remains low in the “traditional” school. As a result, the observation is that the use of technology is making work, and life, more difficult for teachers, especially those who are not necessarily technologically inclined. The same can be said for teachers who are not being provided with the professional development and the classes they need. As a result, many educators have reported that they do not feel comfortable using technology in their classrooms. Some have gone as far as to say that they feel that it “undermines them as a figure of authority,” putting the lead teacher role on the devices and programs instead.

According to Gomez (2016), the use of technology in a school setting, in homes, and in public libraries and learning centers could widen the economic gap, as well as have a possible adverse effect. This means that all the improvements technology makes to the academic experience, can have the potential to take away just as much, or more, if not implemented correctly. Continuing his research, Gomez points out that the opposing argument, made by those who support the integration of technology into classrooms states that “personalized learning is best provided with the support of computers” (p. 52) The classroom teachers should be included in the original design of curriculum and instruction as schools aim to move away from just-in-case and everything-at-once learning.

Just -in-case learning refers to the idea that sometimes what is being taught to school aged-children is being taught “just in case they need this in the future.” Additionally, everything-at-once learning is the idea that students are presented with all of the information on a topic at once, then go into detail (top down), rather than being presented with small details and pieces of information individually to reach the conclusion on their own (bottom up). However, taking all

of this information, and all of these opinions into account, several authors cited in Gomez's work have reported that "computers have had little to no effect on teaching and learning in schools" (p. 53).

In an attempt to find solutions to these problems, which have been said to prevent teachers from using technology in their classes, Eren and Sahin-Iznirli (2012) surveyed and studied the responses of school principals, IT instructors, and teachers. The authors separated their potential problems and solutions into four separate categories: educational program, structure of IT courses, institutional infrastructure, and stakeholder's perception. Within these categories, the following problems were found: a) the IT courses were losing their function and no longer relevant or important, b) the IT course's books and study materials were no longer meeting the needs of the students, and c) the structure of the course and of the education system were problematic, mostly because the IT courses were no longer required (they were optional), when they were being offered, was not offered frequently enough.

Other problems found in the study related to the fact that d) the technology present within the course was not up to date, e) the classrooms were over crowded, f) several of the IT course classroom's computers had been relocated to other rooms in the building for use by regular classes, and g) the classrooms were also lacking several other general instructional materials, making it impossible to effectively teach the courses. Within these categories, one solution was suggested for each problem. The solution for the issue with educational programs was to develop a program that was more specifically designed to accommodate the needs of today's society. To solve the problems associated with the structure of IT courses, the authors proposed that school principals and teachers become more aware of the courses available to them, that the courses

themselves be taught by graduate students who are currently enrolled in an IT program, and people who have just finished learning the content themselves. As far as the infrastructure, it should be updated. The authors believed that if these four suggestions are followed, schools and teachers will find relief from their negative perceptions of using technology daily in the classroom, therefore improving the education of their students.

In addition to the four, general suggestions listed above, the authors also listed several direct improvements to be made to the instruction of and requirement of IT courses. According to the article, the content included in the IT courses should be up to date, and maintained for relevancy in such a way that current needs are being met, the lessons within these courses should also be instructed on a project basis, instead of on a lecture basis. The authors also recommended that the courses be required, and only offered as optional later, when the students are more advanced and the grade level is higher. The students should also be encouraged to choose their own courses, based on their own ability levels and desire. The choice should not be made for them by management.

Further recommendations made by the author focus on the instruction and structure of the course. According to the article, IT courses are applied courses, and, therefore, should be taught around time and content management, twice a week. Another important aspect of designing an IT course, according to Eren and Sahin-Iznirli (2012), is the idea that because technology is ever-changing and constantly being improved, the courses should be designed with these changes and developments taken into account.

People's Perceptions of The Use of Technology in Classrooms

As previously reported, it is believed by some classroom teachers and school staff that the use of technology in classrooms is difficult and undermines to the instructors in the class.

Following these negative perceptions, Pierce and Ball (2009) researched to determine the factors that contribute to these beliefs. The authors studied a group of 92 teachers, prompting them to answer questions that would reveal the reasons why they feel uncomfortable around technology in their classroom. Focusing on both computer-based technology, as well as hand held devices, like calculators, this study examined what makes teachers feel reluctant, as well as what goes into persuading teachers to switch from “pen and paper” instruction to one that is more technologically influenced.

Among other conclusions surrounding enabling factors and potentially feared barriers, the study revealed that most teachers' attitudes toward the use of technology in the classroom depended on how they felt it would influence the education of their students. Teachers are influenced by the social norms attached to the use of technology in their schools, and respective school environments. So if other teachers in the building are using technology, they think that maybe they should too. Or, conversely, if no one else in their building is using the technology, teachers think that they shouldn't either. One other determinant of whether or not teachers will use technology in the classroom is the perceived behavioral norms that go along with it. The major issues with using technological devices in classes were the effects it could have on the

extra time needed by the teacher and the students to learn effective skills and the assumed cost restraints associated with supplying devices to all students. Many teachers reported that they did not feel comfortable requiring students to use devices that they may not be able to afford. Another popular fear among teachers was in relation to their own level of self-efficacy. Many teachers believed that they were not properly prepared to use the devices themselves, let alone teach their students to use them, all of which can be observed in Table 6 below.

Table 1 MTPS items with codes and percentage of respondents for each option

	Codes	Mathematics with technology perceptions survey item	SD	D	N	A	SA
1	AT E	If I use more technology, my students will be more motivated to work on their math	3	9	30	50	8
2	AT B	Students don't understand math unless they first do it by hand	4	48	24	18	5
3	BC B	If there are unexpected problems caused by technology this will be very difficult for me	16	45	17	17	4
4	AT E	Technology can be used to help students gain a deeper understanding of math than is possible in a by-hand classroom	2	8	12	59	20
5	SN E	The math co-ordinator (or principal) expects me to use technology in my math classes	2	5	13	51	28
6	SN B	My colleagues think that when my students use technology for math they are 'just pressing buttons' and not really learning math	12	52	21	14	1
7	SN E	My students' parents think more technology should be used in math classes	1	23	60	15	0
8	BC B	If I use more technology I won't have time to cover the course	14	47	15	22	2
9	BC B	Technology is too expensive for my students to access	9	39	20	26	6
10	AT E	Using technology makes math more enjoyable for my students	0	2	11	62	25
11	BC B	Learning to use new technology for my math classes will encroach too much on my personal time	11	56	17	10	5
12	AT E	Technology can be used to allow my students to engage with more real world problems	2	4	9	61	24

Table 6: Responses to items asked in the survey (Pierce and Ball 2009)

(In this table, AT represents attitude, SN represents subjective norm, BC represents the perceived behavioral control, E represents an enabler, B represents barriers, SD represents strongly disagree, D represents disagree, N represents neutral, A represents agree and S represents strongly agree.)

Classroom teachers and school staff are not the only ones with opinions on whether or not classroom technology is effective and appropriate. According to Thomas and Munoz (2016), students also have strong feelings regarding the incorporation of devices into their daily educational experience. This study, examined the perceptions associated with a school's proposal

for students to use their own hand-held mobile devices, including, but not limited to, tablets and even smartphones. By the end of the survey, 90.7% of all students included reported that they were already using their own devices during class time and work, for “school related” work. Of that 90.7%, only 73.8% supported the formal integration of personal devices in the classroom setting. The remaining student population reported a fear that the casual integration of smartphone and personal tablet devices during class-time would have an adverse effect on the education not only of the students who use them, but those around them as well.

According to the responses to this survey, students believed that these devices may be too disruptive and distracting to all students in the classroom, that it is inappropriate and that it would make it difficult to learn. According to Hashim (2016), another student perception, or in these cases, concern, is that the use and support of technological devices in the classroom will encourage students to use the internet as a resource too often, which, according to the medical students surveyed, could result in an “internet addiction.” Allowing students to frequently use technological devices during the course of study may enable them to rely on the internet too heavily for answers, eliminating the need for them to learn on their own. In this case, the main point seems to lie in the level of guidance and supervision. It is key that students do not become too dependent on technology; that they use these devices, and the resources made available by them, responsibly.

Teacher’s Self-Efficacy and Professional Development

Since the question of whether or not to use technology in the classroom is one that is frequently asked, another point to be examined is how to implement technology successfully.

According to an article by Koc (2014), one answer lies in teachers' attitudes toward the devices available to them. To arrive at this conclusion, researchers closely examined the relationship between a group of classroom teachers and their available technological devices. The author found that the educators studied had, for the most part, a positive attitude toward the idea of technology in the classroom. However, they did not feel comfortable using it and working it into their pre-existing lessons. Additionally, although the majority of the teachers involved in the study felt positively about using the technology, some felt that relying too heavily on it would eventually undermine the role of the teacher. Taking all of the results of this study into account, Koc found that a more positive attitude toward the use of technology in the classroom leads to an increased frequency of use, and, similarly, that a negative attitude toward the use of technology leads to a decrease in its frequency of use.

These same results were found in a study done by Kretschmann (2015). In his research, the author surveyed 57 physical education teachers at the high school level. The point of his study was to research the effects of the use of technology in physical education classes; the relationship to the teacher's computer literacy skills, and the frequency with which technology is being used. In order to achieve appropriate results, Kretschmann distributed a questionnaire to participants which focused on personal information, such as, age and gender, as well as the instructional technology used in classes. The results of disclosed that the teachers' level of self-efficacy, or computer literacy directly impacts the amount and ways in which technologies are used. In this case, research was aimed at how physical education teachers use assistive technology in their classes, which for some may seem odd, or misplaced. Of the instructors

surveyed, 17.55 % were considered low level computer literacy users, 45.6% were considered to be of average computer literacy and 36.84% considered high level computer literacy instructors.

In addition to finding that the computer literacy skills of instructors had a direct, and often positive relationship on the effectiveness of the use of technology in courses, the study also found there was no relationship between the gender of instructors and their level of self-efficacy. However, there was also a direct and positive relationship between age and computer literacy, meaning that, regardless of gender, the instructor’s age does affect his/her level of comfortability with technology, and, therefore, the frequency and extent to which it is used within their courses.

However, just like teachers in the general education classrooms and in the special education classroom setting, physical education teachers are encouraged to use communication devices, digital and video cameras, and in some cases, laptop computers. As seen in table 7 below, video, stereo, and imaging technology were of the most prominently used.

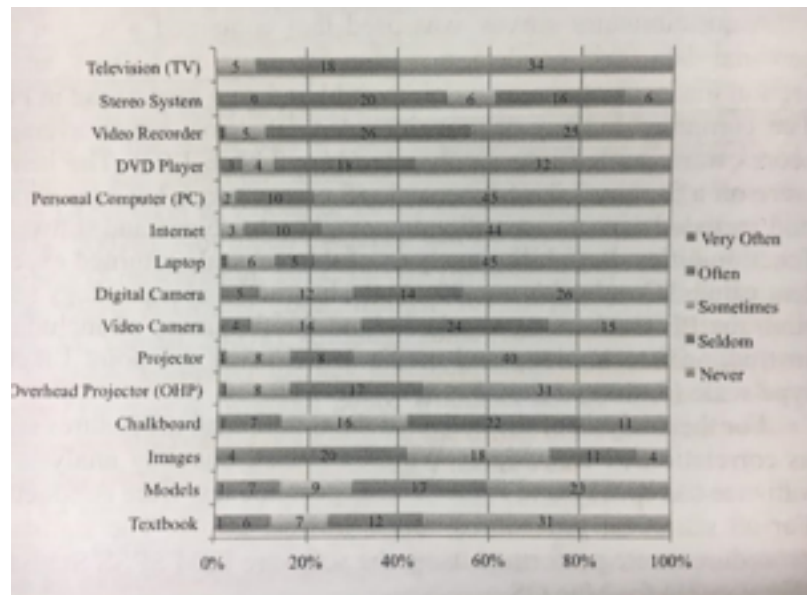


Table 7: Instructional technology and media use in PE (Kretschmann, 2015)

Because the level of teachers' self-efficacy is such an important aspect of how much it is used in schools, several researchers have set out to determine the best ways to improve the comfort of teachers and encourage them to use these devices more. Morsink, Hagerman, Heinz, Boyer, Harris, Kereluik, and Hartman (2011), introduced 13 primary school teachers to professional development courses based on the National Education Technology Plan. The professional development was fast paced, crash courses on specific devices and instructional methods, to deepen their technological, pedagogical, and content knowledge (TPACK).

TPACK is the relationship among the understanding of a teacher's technological knowledge, technological content knowledge and their knowledge about teaching as a practice. According to the article, the TPACK perspective strongly disagrees with the idea that technology integration in educational settings should focus on the mastery of use of one specific device. Instead, the authors point out that educators have a mindset that is open to the following: a) an awareness that technology is constantly being updated, and that the skills one has acquired could very well change. These changes should be seen as beneficial. Educators should also be open to b) ongoing professional development and reflection opportunities, c) a willingness to apply new methods and strategies to instruction, d) innovative use of devices in instruction in new and exciting ways, and e) an acceptance that in spite of all that technology offers, it also has constraints, which effect and could change the educational experience for teachers and students alike.

The article continues by saying that educators should have an awareness that the use of technology is an ongoing commitment to maximize opportunity and minimize constraints for

students, as well as an ongoing commitment to learn more about the technology, the devices, the software and the tools through expert advice, and the advice of peers. Exposure to these courses, and to the general understandings necessary to optimize the use of technology, made it clear that teachers could easily and quickly improve their level(s) of self-efficacy, and found that once they had, the teachers were more likely to integrate the devices into their day-to-day lessons, as well as maintain their knowledge and use of the technology they have available to them.

The authors also pointed out that as teachers begin and continue to use technology in their lessons, they may do so in a number of different ways: a) start high, plateau, b) start low, plateau, c) plateau, climb, d) climb, climb, and e) climb, decline. Start high and plateau means that the instructor begins with a considerably high self-efficacy in technology, and then plateaus, or reaches a moderate level. Start low and plateau means that the instructor begins with a low self-efficacy level, and then increases to a moderate level, before plateauing, and remaining there. Plateau and climb means that the instructor begins at a moderate level and improves to a high level of self-efficacy as the observation continues. Climb, climb means that the instructor begins at a low level of self-efficacy, then climbs to a moderate level, and continues to climb to a high level as the observation continues. Finally, climb, decline means that the instructor begins at a minimal level of self-efficacy, improves to a moderate level, and then declines back down to a minimal level as observation continues.

Lim, Sing-Chai and Churchill (2011) set out to determine the most important factor in successful implementation of technology in classroom lessons. They designed a study to identify a system which optimizes teachers' self-efficacy with technology in the classroom. The results of this study was found that in order to ensure that teachers are comfortable with and using

technology to their fullest ability, schools should follow six strategies, that fall under the headings of vision and philosophy, program, professional development, infrastructure, support resources and communication of research. The authors of this article believe that if these six strategies are followed, teachers will improve their own levels of comfortability with the devices they have, and use them more frequently in their classrooms.

Because of all of the talk of the importance of technology in school and of research being done on how to optimize its use, teachers are feeling pressure to perform technologically in their daily lessons. Even with this pressure, most educators believe that the integration of technology better prepares students for success and help them to improve their academic career(s). Although most educators feel this way and agree that technology should be used daily, many of them still do not follow through by incorporating technology in the classroom. For the most part, the educators who reported NOT using the devices said that it is because they are not fully prepared to do so. Instead, they have been found to only use devices minimally. For example, they use Smartboards as nothing more than projectors, for the class to see the same content they would be reading on the board, or to search for examples online. The results of this report were that if teachers do not feel comfortable using the devices they have, they will not use them. For this reason, educators and administrators should recognize the importance of professional development and teacher training.

This conclusion is reinforced by an article by Pittman and Gaines (2015) whose research found that only a small percent of teachers surveyed were determined to be “high-level” technology users, meaning that they use technology frequently, appropriately, and effectively. Reiterating the fact that there is a direct and positive correlation between the attitude of teachers

and the degree to which they use it in their daily lessons, this article also found that there is no relationship between the frequency of technology use and the age, gender or experience of teachers. The researchers interpreted that to mean so long as teachers have technological devices made available to them, and are provided with courses and training to improve their knowledge of them, they will use the devices in their classes more, and to a more advanced degree.

Because technology has proven to be so transient, teachers often are unsure of how to incorporate it into their work appropriately each day. According to an article by Muilenburh, Lin and Berge (2015), which studied classroom teachers grades K-12, technology is not being effectively incorporated into lessons because the teachers are unsure how to do so in such a way that would allow them to modify changes for the future, that is, for the inevitable changes made to the devices or the software. The purpose of this article was to take this perception, find ways to alleviate the pressure felt by educators, and suggest ways to make modification easier. Using the Technology Integration Matrix, or TIM, the authors focused on the entry, adaptation, adoption, infusion, and transformation of technology in classes. Using this system, authors found a significant importance of the classroom environment, not just the self-efficacy of teachers.

According to the article, environments that are active, collaborative, constructive, authentic, and goal-directed are some of the most important factors taken into account when implementing technology effectively in classes. Additionally, the authors of this article found that, just as those previously reported, the degree of knowledge of classroom teachers is another one of the most important contributors to a successful technology-friendly classroom. The authors used the TPACK model, which encompasses following seven examples of teacher knowledge: content knowledge, pedagogical knowledge, technical knowledge, pedagogical

content knowledge, technological content knowledge, technological pedagogical content knowledge, and technological content knowledge. According to the article, all of these levels of knowledge contribute to the degree to which technology is used, and how effective the use of the technology is in relation to the content being taught. Models like TIM and TPACK reinforce the findings of the other articles reported. The models show that technology use in classrooms is a key part of the academic success of students, and that this success is directly dependent on the teacher self-efficacy.

Conclusion

Therefore, the use of technology in the classroom, and in academic settings, is a positive influence on students, and on their school experience and success. However, it is crucial that teachers be provided with substantial professional development courses, and opportunities to deepen their knowledge. The integration of the devices they have should provide the most appropriate and effective learning experience for students.

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