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Abstract

This research project aims to examine the impact of technology on K-8 students' learning post-COVID-19 and how technology in the classroom helps students achieve academic success. With the difficulties that the COVID-19 pandemic had on students, this study will dive deep into the depths of technology's use in today's education system. Through the use of a literature review, interviews with teachers, and surveys from 7th & 8th-grade students, the findings indicated that technology plays a crucial role in students learning and teaching. We are moving away from the traditional classroom of books and paper and into a new era of technology.

Introduction & Background

Technology has been around for a long time, and it was not until the 1920s that it made its way into the classroom. Believe it or not, the radio was the first technology ever used in schools. As time passed, technology advanced and was introduced into classrooms to help teachers create a better learning environment and assist students in their academics. With the advancement of technology in education, massive amounts of information (books, audio, images, videos) become available at a student's fingertips through the internet and provide opportunities for formal learning online worldwide through the Khan Academy, MOOCs, podcasts, traditional online degree programs, and more (Maryville University, 2019). Thus, technology may play a vital role in students' education and learning, allowing them to access multiple tools to help them develop and evolve as learners. Technology is a magic bullet that improves teaching and learning, disciplines students as a skillful future workforce, and enhances democracy in educational institutions and the larger society (Teras et al., 2020, p.866).

This paper's main question is how technology impacts K-8 students after the COVID-19 pandemic. Technology has been around for many years and has made its way into our education system, but we really need to know if technology impacts students' learning positively or negatively. Researching the impact of technology on K-8 students' learning is significant because, as a future teacher, I am curious about how technology affects students and teachers in our educational system post-COVID-19. I will be doing background research about the impact of technology on K-8 students' learning post-COVID-19. Also, I will go into depth about what technology is, the kinds of technology tools that K-8 students have used effectively in the classroom, and to what extent. To answer these questions, I will go through the following steps: I will interview four teachers (See Appendix A ~ Interview Questions to Teachers) and gather

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many peer-reviewed articles and other internet information to help me answer my primary and secondary questions. Also, I will get surveys from two different classes (See Appendix B ~ Anonymous Survey Questionnaires for Students) to help me better understand the impact of technology on K-8 students learning. Surveys from students will let me know if technology is helping students' learning or if it is more of a distraction.

The primary purpose of technology in education is to increase student engagement, help teachers improve their lessons or teaching skills, facilitate personalized learning, and help students build essential skills that they will use in today's society. Today, students are growing up in a time when technology is a competitive fad (Castens et al., 2021, p.105). Without technology, education and classrooms will revert to traditional ways of student isolation with no opportunities for collaboration. However, an education system integrating technology in their classrooms will provide student communication and collaboration opportunities. Students can share what they are learning with students in other classes who are learning the same material. The classroom walls are no longer a barrier as technology provides new ways of learning, communicating, and working together (Maryville University, 2019). Therefore, to deny students the opportunity to use technology to obtain a well-rounded education incorporating engagement, collaboration, and communication is to prevent them from reaching their full potential.

Before the COVID-19 pandemic, technology was just another accessory for teaching or learning. Most teachers did not take full advantage of technology's new resources and continued to teach through lectures, books, and writing with pen and paper. Technology became the most essential educational resource once all schools entered distance learning due to the COVID-19 pandemic. Due to the high demands during the COVID-19 pandemic, just in the last year, the California Department of Education (CDE) distributed more than 46,000 Chromebooks and other

technology devices, such as Wi-Fi hotspots, to schools so they can help students attend class remotely. With the increase of technology in our education system, more schools have integrated new technology into their classrooms. Some of the top classroom technologies used today include Education technology (EdTech), video conferencing platforms, online textbooks, asynchronous/synchronous learning tools, and a learning management system (Purdue Online, 2021). Now that the pandemic has ended, it is our job to determine whether or not technology is helping students thrive to better academic success and its impact on their learning outcomes.

As a future teacher, I believe that this will contribute to my professional and academic goals by finding a way to implement the most helpful technology into my career and which technology tools will help me strive as a student as I finish my last semester at California State University Monterey Bay (CSUMB). My primary research question is: How does technology impact K-8 students learning post-COVID-19? My secondary research questions include:

1. What is technology and the kinds of technology tools that K-8 students have used effectively in the classroom post-COVID-19? And to what extent?

2. What does the research say about the impact of technology on K-8 students' learning post-COVID-19?

3. Are there pros and cons to using technology for K-8 classroom students? If there are, what are they? What kinds of technology tools that teachers find helpful for K-8 students post-COVID-19? If so, how did they use them in the classrooms?

4. Did teachers find it helpful or harmful to the student's classroom learning?

5. Are there resources available at school to provide technology tools for K-8 students to enhance their learning? If there are, what are they? If not, what could schools do to secure

sufficient technology resources for their students?

6. What will the future hold for the role of technology to enhance K-8 students' learning?

To seek the answers to these research questions, I will start with a review of the current academic literature.

Literature Review

For this section of my senior capstone research paper, we will cover what is already known about the impact of technology on K-8 students' learning, what the directions indicated by the work of other researchers, and see what the most fruitful direction for future research is. Since the COVID-19 pandemic forced schools into distance learning, technology in the classroom has become a high demand for schools worldwide. Teachers were forced to learn new ways of teaching by integrating different types of technology into their day-to-day lessons. Most importantly, technology improvement has improved for school districts, allowing students access to wifi hotspots and Chromebooks. Once the pandemic ended, technology became even more significant in the classroom, allowing teachers and students to become fluent in technology. Online platforms developed because of COVID-19 have given teachers valuable technology tools for engaging students in their instructions and evaluating their progress efficiently(Beets, 2023). Students now have the ability to track their progress in the class to see if they are struggling or succeeding. Also, both teachers and students have access to communicate with each other outside of the classroom. Students who struggle with a specific assignment can now communicate via technology tools with other students or the teacher. Now that we have covered what is already known about the impact of technology on students' learning, we will review the work of other researchers.

The research that I have found supports my research topic in many ways. Through long hours of reviewing different types of current academic literature, The impact of technology on K-8 student learning post-COVID-19 is prolonged. Technology is opening the doors to new ways of learning and teaching. It gives diverse opportunities to meet all student's needs. Ironsi (2022) stated that:

> It is important to pinpoint that the enormous role of technology in facilitating continuity in educational activities tends to make research on technology and teaching of global importance in recent times. Already, prior studies recognize the role of technology in impacting positive learning outcomes as they found that the use of technology produces positive learning outcomes in a given instruction. Recent reports reveal that learners using technological devices for more than 60 minutes per week achieve higher academic results as compared to others who use technology for lesser minutes during lessons (p. 2)

Even though there are many benefits to technology being at the forefront of education, a significant amount of research has emphasized the need to train learners and teachers while using augmented reality in the classroom (Ironsi, 2022). Most teachers and parents have concerns about digital distractions affecting the success of student learning since there is unlimited access to technology. Do the concerns of teachers and parents outweigh the results of the impact of technology on students' learning? The abundance of technology in the classroom has dramatically impacted education. It has transformed the way teachers teach and the way learners learn. Teachers are more than teaching their lessons; they have become more hands-on and assist students with their devices' activities. The cost and expenses for these devices can be a challenge. For the technology to be most effective, studies show that schools are moving to provide students with their own laptop computers, netbooks, or digital tablets (Herold, 2016). A one-on-one learning device works best for students, allowing each student to focus on the screen and hold their attention. Another issue is accessibility. Nearly twelve percent of students do not have access to the internet or computers at home (Purdue Online, 2021). This issue puts less fortunate students at a severe learning disadvantage through no fault of their own. With the ever-changing technology we have today, it is hoped that we move towards giving all schools

and students full access to it. The hope is that students can now do more complex and creative work with the new technology tools they now have access to (Herold, 2016).

Through the work of other researchers, I have also learned that technology impacts student writing quality and quantity when reviewing elementary classroom writing performances. To be literate today, a person needs to be able to read and write on paper and on a screen and be proficient in searching, downloading, evaluating, and editing online content (Wen & Walters, 2022, p.2). Students who struggle with writing can use different technology tools to help them improve their overall writing skills. Having Chromebooks in the classroom can now be used as word-processing tools to help students develop or struggling writers write electronically and edit text easily. Technology supports like spelling, grammar checkers, formatting, and planning/outlining features motivate "reluctant" writers to engage in the writing process and improve their writing quality as ideas that can easily be refined or deleted (Wen & Walters, 2022, p.2). Technology has a massive impact on students' learning, either in writing or other subjects in the classroom, and the different literature provided supports my primary and secondary questions of this research project.

When looking to see what the most fruitful direction for future research says about technology in the classroom, the current academic literature is leaning toward Artificial intelligence (AI). Artificial intelligence is already developing fast in the area of technology and is being used in various ways. Numerous studies have demonstrated the advantages of incorporating AI into the classroom (Alam, 2022, p.395). Artificial intelligence has already had a significant impact on the way classes are presented and how students are being taught. Artificial intelligence can be used in the education system in different ways, such as adaptive learning, teaching evaluation, virtual classrooms, and intelligent tutoring robots. In adaptive learning,

teachers can utilize artificial intelligence to assist them when communicating with students online questions, this especially helps when the problem can not be solved in the classroom. Students tend to perform better and retain more knowledge when they use learning analytics and real-time analysis powered by artificial intelligence (AI) (Alam, 2022, p.396). The biggest surprise about what the future research says about the impact of technology is intelligent tutoring robots. Alam (2022) stated that:

> Technology's educational potential is increasing, and as a consequence, robots are gaining popularity. In the 1960s, Prof. Papert at MIT's artificial intelligence department created the world's first teaching robot. Educational robots are those that have been purpose-built to assist students in developing their analytical, creative, and practical skills in educational environments (p.400).

Having intelligent tutoring robots assist students in their learning process will open a wide range of information to students who need extra support with their academic work. There will always be a conflict between a student's interest and a human tutor's. Having robot tutors will demolish that conflict and encourage students to engage more in their work. The employment of robots in the classroom can be beneficial in sparking a student's enthusiasm for learning (Alam, 2022, p.401).

Methods and Procedures

At the start of this fall semester, 2023, I already had a capstone project in mind. With the help of Dr. Thao, my capstone professor, I refined my research topic. When I revised and completed my prospectus final paper, I became grounded in my research and found the focus for this senior capstone research project. To seek the answers to my primary and secondary research questions, I conducted many peer-reviewed scholarly articles and other articles that are connected to my research questions. Throughout this process of Internet research, interviews, and anonymous student surveys, I collected current literature related to my research questions. There were minor setbacks when obtaining information about student learning post-COVID-19.

However, after long-continued research, I found specific articles that pointed me in the direction that helped me find the research I was looking for.

In order to find out how technology impacts K-8 student learning post-COVID-19, I spent countless hours in classrooms, seeing the effectiveness of my research topic firsthand. Aside from researching the internet and spending time in classrooms, collecting five interviews from K-8 teachers helped me better understand technology's impact on student learning. (See Appendix 1 ~ Interview Questions to Teachers). These interviews gave insight into how teachers define technology, the technology tools students have used effectively, some pros and cons, and the types of technology tools that are helpful or harmful to students' learning. I also wanted to know teachers' views on technology's future in their classrooms.

After conducting interviews with five different K-8 teachers, I also sought out what students thought about the technology they use post-COVID-19 by collecting data from an anonymous survey of sixty students (See Appendix 2 ~ Anonymous Student Survey). In these anonymous surveys, I wanted to determine if technology impacts student learning positively or negatively. I developed nine kid-friendly questions to help me learn more about my research topic. I am thankful to have had experience in different K-8 classrooms with the help of my previous job, as it was vital to my capstone project. Between the substantial amount of research that I have gathered, the interviews I collected, and student surveys, my approach has assisted me in thoroughly answering my research questions leading up to the results.

Results, Findings, and Discussion

Through thorough research, my results indicate that technology is vital in impacting K-8 student learning. Technology is an essential feature of student development. The most frequently measured pedagogical aspects of technology integration in classrooms are in instructional

practices, which include using technology to enhance students' cognitive engagement, promoting collaboration between students, and allowing students to conduct research online (Consoli et al., 2023). Technology in the classroom provides students with easy access to information that will help them understand complex concepts. After collecting data from a student survey, ninety-four percent (94.7%) believe technology is essential to their learning (Student Survey, See Appendix 2 ~ Anonymous Student Survey).

Generally, technology improves student performance when the application directly supports the assessed curriculum standards. In other words, technology can have its most significant impact when it is integrated into the curriculum to achieve clear educational objectives. Recent studies have illustrated that alignment between content-area learning and selected technology can significantly increase test scores (Cradler et al., 2002). Another way technology impacts student learning post-COVID-19 is through motivation. As teachers, we are responsible for motivating students in their learning process. The more a student is engaged and motivated, the more likely they will learn something new and retain the material taught. Research shows that incorporating technology in the classroom motivates students to learn. For instance, allowing third-grade and first-grade students to collaborate and create a technology tool that will help kindergarteners practice math strategies enhanced the motivation of those students because it gave them a real-world purpose for planning and creating collaboratively.

> The usage of technology in the classroom comes with its many perks, according to teachers in the district. With the inclusion of technology in the district, we are opening our students up to so much more information than we could do with the resources within our classrooms. Technology is how kids learn in the world today, and it is what they feel most comfortable using. Technology provides a high student interest, allowing them to engage in their learning at multiple levels. With the growing amount of technology, teachers feel that students have a good deal of choices when studying and allows them to be self-sufficient learners in and out of the classroom (Carstens et al., 2021, p.109).

Surprisingly, only 61.4 percent of students say they use more technology in the classroom post-COVID-19.

What does the research say about the impact of technology on K-8 students' learning post-COVID-19? Are there pros and cons to using technology for K-8 classroom students? If there are, what are they?

After researching the impact of technology on K-8 student learning, I found that hundreds of studies show that technology in the classroom increases students' retention of course material. Through multimedia learning, students can encode visual and auditory information into their memory as they listen to instructors (Richmond & Troisi, 2018). Once the COVID-19 pandemic ended, technology's overall use has improved significantly. Most public school districts have achieved a one-to-one ratio of technology devices to students.

Today's technological advancements allow for new forms of learning in ways never imagined in the educational system. The ability that educators now have to unite students and allow tremendous opportunities for new and exciting experiences is now being explored. For example, students living in a rural area in the United States can follow the family lifestyle of someone living in the arctic in real time. Things like daily blogs and videos allow students across the globe to feel connected like never before (Maryville University, 2019). Multiple learning options for single subjects are another substantial positive for technological advancements. Students struggling with a particular subject can now view many different ways to learn the material (Purdue Online, 2021). Maybe the student is struggling in Math. Instead of only being able to look at a textbook and hear a teacher's instruction, they can now access online material like Cool Math Games, which delivers the material to them in a fun and engaging way. The use of technology in the classroom provides students with personalized learning plans.

> Technology allows 24/7 access to educational resources. Classes can take place entirely online via the use of a laptop or mobile device. Hybrid versions of learning combine the use of technology from anywhere with regular in-person classroom sessions. In both scenarios, the use of technology to tailor learning plans for each student is possible (American University, School of Education, Online Programs, para. 17).

Having tailored learning plans for students allows teachers to create engaging lessons based on their student's strengths and needs. It also allows students to be more independent by completing their work at their own pace. If students struggle with their work and need a better understanding of concepts, technology allows them to review videos in the lesson plans. The data generated through different online activities enable teachers to see which students are struggling and offer help or support (American University, School of Education, Online Programs, 2020).

Although technology benefits student learning, many cons come with using it in the classroom. For example, K-8 students have unlimited access to technology devices twenty-four/seven and have become accustomed to them. Using digital devices all the time can affect students' fine motor skills. Students in the twenty-first century have moved away from pencil and paper and into touchscreens or typing. Students who use numerous hours of technology at home show up to school needing help to hold a pencil correctly or cut paper with scissors. The intense use of technology at home or in the classroom prevents students from developing significant strength that leads to fine motor skills. Teachers "encourage their students to do at least some writing by hand because they feel students do more active thinking, synthesizing, and editing when writing by hand (Carstens et al., 2021, p.106). Writing by hand will help students strengthen their fine motor skills to enhance their overall development.

Aside from affecting fine motor skills, the use of technology in the classroom can be a distraction to students. Technology in the classroom can become a distraction to students when it is misused, which hinders learning. Studies have shown that when students have free access to their cell phones in class, they perform half a grade lower than when they do not use their cell phones (Richmond & Troisi, 2018). Only allowing students to use technology in the classroom

some of the time can help students succeed academically. Students tend to perform better on tests when they revert to traditional ways by taking notes on paper rather than on devices.

Studies like this have the added boon that they dodge the issue of distraction in the classroom -- another learning hindrance for sure -- because the experimental procedure made it so laptops could be used only for note taking. So, it's not just a distraction that's the problem, it's the actual process of taking notes on a computer that hurts learning (Richmond & Troisi, 2018, para 7).

What kinds of technology tools that teachers find helpful for K-8 students post-COVID-19? If so, how did they use them in the classrooms?

When conducting countless hours of research and teacher interviews, I learned that most teachers use different types of technology in their classrooms. For instance, when interviewing a first-grade teacher, Michelle, she stated that the technology tools that she prefers to use are helpful for her students post-COVID-19 are "Chromebooks, Lexia Core5, and Seesaw" (Michelle, personal communication, Oct 1, 2023) (See Appendix 1 ~ Interview Questions to Teachers). Michelle uses Chromebooks in her classroom because they allow the students to access various learning resources such as Lexia Core5 and Seesaw. The way teacher Michelle uses Lexia Core5 and Seesaw is in small groups during center time. Other technology tools teachers use in the classroom today that they find helpful for K-8 students are speakers, microphones, laptops, Google Classroom, Google Slides, doc cams, giant TV screens, Newsela, IXL, the internet, and Kahoot. When interviewing a fourth-grade teacher, Karen, about the technology tools she uses in her classroom, she mentioned that in the past ten years she has been at Linscott Charter School, the school has invested in new technology to support teachers. When she first arrived, there were old projectors and only one or two computers in each classroom. Since post-COVID-19, there have been "new doc cams, large TV screens, and a Chromebook for each student to use in the classroom" (Karen, personal communication, Sept 28, 2023) (See Appendix 1 ~ Interview Questions to Teachers). Karen uses these technologies in her classroom

using the doc cam to project lessons on her big-screen TV. She also likes to use her speakers to play symphony music in the morning to help students relax as they walk into class. Aside from using her doc cam, speakers, and big-screen TV, Karen enjoys using her microphone to project her voice around the classroom so that every student can hear her as she teaches a lesson. When asked how she uses Kahoot in the classroom, Karen stated, "I use Kahoot as a part of my lesson to help students play an interactive game while learning together in the classroom" (Karen, personal communication, Sept 28, 2023) (See Appendix 1 ~ Interview Questions for Teachers). These are just a few examples of technology tools used in today's classroom post-COVID-19.

Did teachers find it helpful or harmful to the students' classroom learning?

Different technology tools at teachers' disposal can benefit their students learning in many ways. As mentioned earlier, Michelle uses Lexi Core5 because it helps her students build phonemic awareness, phonics, and reading skills. She also has the students use Seesaw because she can tailor the lessons on Seesaw to match her current curriculum, which is helpful to students' classroom learning. Through my interviews, Google Classroom has been found to be an effective technology that is helpful for students. For example, Google Classroom is an online application where teachers can create engaging lessons, organize assignments, provide feedback efficiently, and communicate with students in their classes. When interviewing a sixth-grade teacher, Seth talked about using Google Classroom to help with "assigning assignments and a place where his students can submit final drafts" (Seth, personal communication, Oct 12, 2023) (See Appendix 1 ~ Interview Questions to Teachers). Seth finds Google Classroom helpful because it allows him to be more in-depth with his assignments and have immense resources to use. With the end of the COVID-19 pandemic, Google Classroom has become a significant

technology tool for all teachers and students. Teachers who have returned to school and are teaching in person find Google Classroom more successful in K-8 student learning.

> Google classroom can be elevated to become a pedagogical/cognitive tool to help in changing the focus of the classroom from one that is teacher-centered and controlled to one that is learner-centered and open to inquiry, dialogue, and creative thinking on the part of learners as active participants (Shaharanee et al., 2016, p.5).

Another technology tool helpful to students' classroom learning is Google Slide; instead of a teaching lecture about a lesson for thirty or forty minutes, where students can lose their attention quickly. Google Slide provides engaging opportunities for all students to stay focused during direct instruction. When interviewing a seventh-grade teacher, Aimee, she loved using Google Slide daily in her classroom. "I use a Google Slide every day because I try to teach in a way that includes all learners: visual, verbal/auditory, etc" (Aimee, personal communications Oct 22, 2023) (See Appendix 1 ~ Interview Questions for Teachers). When asked if she believed it is helpful or harmful to her student learning, she believed that this tech could be harmful to specific students who get distracted easily. However, overall, she believes technology in her classroom can be helpful for most of her students.

Are there resources available at school to provide technology tools for your students to enhance their learning? If there are, what are they? If not, how could your schools secure sufficient technology resources for your students?

After finishing my five teacher interviews with different teachers from Kindergarten to eighth grade and collecting seventh and eighth-grade student surveys, I learned that some resources are available at school to provide technology tools for students to enhance their learning. For example, all five teachers at Linscott Charter School agreed that a Chromebook is the number one resource available to students. Students have daily access to Chromebooks in their classroom to enhance their learning. When analyzing the student surveys, forty-five of sixty

students answered that Chromebooks were the number one technology tool that enhances their classroom and home learning (Student Survey, See Appendix 2 ~ Anonymous Student Survey). Students can take their Chromebooks home to finish their writing, math, and reading assignments. Having the ability to complete multiple assignments with one Chromebook is a significant resource to enhance student learning.

With the daily use of Chromebooks, students can also access Google Docs when typing their assignments. Google Docs is a valuable resource that schools have because it allows students to use voice typing when doing lengthy assignments. In an interview with teacher Karen, she stated that Google Docs with voice typing is essential for her students when doing reports. Most fourth graders have trouble spelling or writing complete sentences, "One thing that is great for students is the ability to type using their voice. Voice typing is often available if needed (Karen, personal communication, Sept 28, 2023) (See Appendix 1 ~Interview Questions to Teachers). Michelle, who teaches first graders, believes that Lexi Core5 and Seesaw are great tools to enhance her student's learning. Students can access hundreds of online audiobooks to help them enhance their reading ability.

Even though there are plenty of resources available for teachers to use, there are still resources teachers are unaware of because of the lack of prep time or because their school does not provide training opportunities, especially for middle school teachers. Teacher Aimee, who teaches seventh- and eighth-grade English and Social Studies, believes that the lack of prep time limits her understanding of technology tools. "I do not have time to learn about new things students can use. I also do not know how to use many technology tools. I would love to expose students to cool tech tools, but there is no time built into my job to prepare for this (Aimee, personal communications Oct 22, 2023) (See Appendix 1 ~ Interview Questions to Teachers).

Aimee also talked about how when she used to work at a different school besides Linscott Charter, the teachers could request a technology coach who specializes in technology to help teachers enhance student learning in their classroom. In order for Linscott Charter to secure sufficient technology resources for their students, Karen suggested "that there are grants available for more tech tools. Access to grants will provide more technology programs that will help all K-8 student learning" (Karen, personal communication, Sept 28, 2023) (See Appendix 1 ~ Interview Questions to Teachers). Unfortunately, some technology tools become obsolete quickly. That is why money must be available for those tools to be repaired or replaced. Schools like Linscott Charter must get technology upgrades to take the federally mandated state tests. As long as those tests are online, schools must provide resources for technology to continue to be updated.

What will the future hold for the role of technology to enhance student learning in your classroom?

The future of technology is bright in education. Many technological tools already exist to enhance student learning, but as time passes, the tools that exist right now may need to be updated. When conducting an anonymous student survey, ninety-six percent (96.5%) said they would like to continue using technology in their future education (Student Survey, See Appendix 2 ~Anonymous Student Survey). Seventh and eighth graders believe that technology will enhance their future education. The future classroom will incorporate digital quizzes, videos, and gamification into course content; teachers can develop a creative curriculum for each student on an individual level (Jain, 2021). When talking to a first-grade teacher about the role of technology in their future classroom, Michelle feels that technology will change drastically. "The future will have more technology; I think it will be more pervasive to have Smart Boards in

every class (Michelle, personal communication, Oct 1, 2023) (See Appendix 1 ~ Interview Questions to Teachers). Having Smart Boards in every class will allow teachers to develop engaging lessons for their students that can link to their Chromebooks when doing an in-class assignment. Another teacher who teaches sixth grade believes that the future of technology in the classroom will continue to become more personalized and differentiated. Even though Seth, the sixth-grade teacher, does not think it will work, "Imagine some people are developing a world where students simply log into a portal and all their instruction will occur via AI. The program/intelligence will constantly monitor student understanding and assigning/teaching the material to the student" (Seth, personal communication, Oct 12, 2023) (See Appendix 1 ~ Interview Questions to Teachers). Artificial intelligence in education (AIEd) will play a vital role in the future of technology to enhance student learning. AIEd can simulate teachers, provide robust student differentiation, and even foster socio-emotional engagement (Schiff, 2021).

Lastly, during an interview with Karen, she said that technology will continue to play a key role for students. When she was in elementary school in the 1970s, it was much more laborious to learn something new. Her library had a card catalog, and she would watch movies on projectors or film strips. Since then, the ability to access information has grown dramatically. "Phones give us access to calculators, timers, learning games, and to fast facts. This will continue to grow over time" (Karen, personal communication, Sept 28, 2023) (See Appendix ~ Interview Questions to Teachers). No one knows what technology will look like in twenty years. However, we know that it will continue to be critically important in education and enhance student learning in the classroom.

Problems and Limitations

Obtaining the information to answer my primary and secondary research questions was uncomplicated. Throughout my literature review, gathering teacher interviews, and collecting anonymous student surveys, I encountered a few minor problems and limitations along the way. However, they did not hinder me from obtaining the needed information. I feel that there was not enough recent data or literature on the impact of technology on K-8 students' learning post-COVID-19. Much of the academic research I have found was on the importance of technology on student learning before the COVID-19 pandemic. I feel that there were only a few articles after the pandemic that would be relevant to my primary and secondary research questions.

Another problem I encountered was collecting my teacher interviews. Initially, I set out to interview five K-8 teachers and could only conduct four interviews. Collecting the interviews was a problem because it was hard to find time for each teacher to sit down in their busy schedule to answer a few questions. I felt like I was being a pest to the teachers by taking up their prep time or asking them to join a Zoom after a long work day. Throughout my interviews, two of the four teachers gave short and pierce answers to my questions. I had to continue to tell them to elaborate a bit more so that I could collect a good amount of information to help my overall research.

Now that I have completed my senior capstone research project, I feel there are more sufficient ways I could have conducted my research and teacher interviews if time was not of the essence. However, upon finishing my senior capstone research project, and as a future teacher, I feel better prepared to implement what I have learned into my classroom and curriculum. I am now aware of all the impacts technology offers K-8 students learning post-COVID-19.

Recommendations

I recommend that it is essential for teachers today to integrate technology into their curriculum and classroom, not only for its benefits on student learning but because it can change how teachers teach and how students learn. Finding resourceful technology tools that benefit teachers and students should be the overall goal when implementing technology in schools worldwide. Educators/teachers should be evolving in the world of technology by learning new ways to teach and learn. We never want to get stuck in our ways because every year, teachers get new students, and it is essential to find ways to keep those students engaged throughout the school year with the use of technology.

Another recommendation is to ask school administrators what technology resources are available to the teachers and students. Knowing what technology resources are available for you and your students is important if you are new to a school. If their resources are old and outdated see if you can find any new resources that will benefit your students. Do not be afraid to try new technology tools that are available. It can be difficult to master at first, but the long-term goal will affect your students' learning in a positive way.

Conclusion

From my extensive research, this senior capstone research project examined the research question, "how does technology impact K-8 student learning post-COVID-19?" Through extensive research from literature review, teacher interviews, and anonymous student surveys, the research findings indicated that technology is vital in impacting K-8 students learning post-COVID-19. Technology provides profound benefits for students to enhance their learning outcomes, such as increasing student retention of course material and having tailored lessons based on their strengths and needs. Thus, public schools integrating technology into their curriculum and classrooms benefits all students' cognitive and social development. With the

advances in technology today, students can now communicate and collaborate with other students worldwide, learning the same material. Technology allows students to be independent, explore online resources, and make meaning for new complex concepts or ideas for themselves. Technology is essential to our society and our education system. We live in the twenty-first century, and new and exciting technology is being created or used everywhere you go. According to the student survey, ninety-five percent (95%) of students say that technology is important to their education, and ninety-one percent (91%) say that the technology they use in the classroom helps them with assignments (Student Survey, See Appendix 2 ~Anonymous Student Survey).

The research supports how technology impacts K-8 students' learning, as do teacher interviews and student responses. Education is something that should be taken seriously. Technology used in the classroom is helpful for teachers and students and changing how teachers teach and how students learn. Incorporating technology tools in English, Math, Science, and History allows all students the opportunity to enhance their learning through various programs and online resources. For example, as mentioned earlier in the results and discussion, teachers can use technology programs like LexiCore5 to build phonemic awareness, phonics, and reading skills. Continuing to integrate technology in public school classrooms will ensure that the next generation of students will be fully educated and ready to overcome any technology demands they may face as they live and work in society.

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Teacher Interview Questions

Karen Interview Questions/Answers: September 28, 2023

1. What is your definition of technology? What technology tools have your students used effectively in the classroom post-COVID-19? And to what extent?

    I think that technology is anything that relates to computers. My students use Chromebooks to write reports, and they film their last report to share with their peers. Students also make slideshows and share videos. After COVID, it seemed like the students had overdosed on tech. Students had difficulty writing instead of typing. They didn't know how to use binder paper, where the margins were, or where the holes on the paper should be located. I felt we should use pencil and paper a bit more, to get their writing skills in better shape. I was worried about their ability to write letters and to form words.

2.   Are there pros and cons to using technology in the classroom?

    I think that there are definitely pros and cons. The biggest pro is that students must know how to navigate technology in their future lives and jobs. It is important for them to be tech-savvy. Technology has greatly changed the way that people interact and has improved the speed at which tasks can be done. The cons of technology are many. Having students type before they learn to write seems like a huge mistake developmentally. Also, technology limits the ability of students to do work "hands-on". There is a lack of neatness and craftsmanship when students return to pencil and paperwork after spending much time using technology. It is easy to have students interact solely online, which is what happened during COVID-19. There is something very important about face-to-face interaction. Students need to learn social skills, they need to read facial cues, and they need to learn how to negotiate friendships.

3. What kinds of technology tools do you find helpful post-COVID-19? If so, how did you use them in the classrooms?

    During the past ten years, our school has really invested in technology. Our school had overhead projectors when I arrived and one or two desktop computers in each classroom. Each class had a small set of five iPads. Over time, we have invested in each student's projectors, laptops, and Chromebooks. It would be nice to have a computer lab where students could work on projects, learn to illustrate, and create artwork. It would also be nice to have computers for research in the library. I appreciate having a projector and a large-screen TV in my classroom. It is helpful to project lessons on the big screen. I like to share music each morning in class. We have a good sound system and microphones to help. The music sounds great, and it is much more interesting for students to see a symphony playing than to just listen to a cd. Our music teacher has the students use

Chromebooks to compose. They also play interactive games together as a part of her lessons. There are also interactive games like Kahoot, where students can play and learn together as a class. Since COVID, there has been an increase in online audiobooks and literature recordings. This has been a great help for struggling readers. I enjoy having the ability to read and edit student work online. I think that it helps the students to easily correct their mistakes during writing projects.

4. Did you find those technology tools helpful or harmful to the students' classroom learning?

   I think that technology is very helpful in the classroom. There is a harmful side if it is used all day, and students are not given the opportunity to unplug. I do ceramics with my students, and we paint. Our school has a Science Workshop, where students make and build, using everyday materials. These activities require complex problem-solving. If students were coding, that would probably replicate problem-solving to a certain extent. As I use technology in the classroom, it seems to just be a supplement to all of the other activities we're doing. It's a means to an end.

5. Are there resources available at school to provide technology tools for your students to enhance their learning? If there are, what are they? If not, how could your schools secure sufficient technology resources for your students?

   I think that it's possible to get grants for more tools. Also, sometimes students who need additional learning help can get technology that assists them. One great thing for students is the ability to type using their voice. This is often available if needed. There seems to be money in the budget when the technology becomes outdated. I have been teaching for a long time and had early Apple computers in my first classroom. Technology becomes obsolete quickly, but somehow, the money gets found to repair and replace it. I believe most schools had to get a technology upgrade to take the federally mandated-state tests. So, as long as those tests are online, the technology will continue to be updated!

6. What will the future hold for the role of technology to enhance student learning in your classroom?

   I think that technology will continue to play a key role for students. The ability to research and to learn is amazing. I was in elementary school during the 1970s. It seems like it was much more laborious to learn new facts. The library had a card catalogue. We watched movies on projectors or film strips. We had overhead and opaque projectors. The ability to access information has grown by leaps and bounds in the past 50 years. Phones give us access to calculators, timers, learning games, and fast facts. This will continue to grow over time. Hopefully, teachers will still take time to do the hands-on activities that help kids to problem solve, and to socialize with one another.

Michelle's Interviews Questions/Answers: October 1, 2023

1. What is your definition of technology? What technology tools have your students used effectively in the classroom post-COVID-19? And to what extent?

    I define technology as anything electrical, like iPods, IPADS, Smartwatches, laptops, Smart TVs, etc. We have effectively used Chromebooks in the classroom post-COVID-19. Specifically, we have used: Lexia Core 5, Seesaw, Discovery ED, Mystery Science, and Youtube. We only used technology 30 minutes a day, and the children used Lexia Core5 or Seesaw during that time.

2. Are there pros and cons to using technology in the classroom?

    Yes, there are pros and cons to using technology in the classroom. The biggest con is that it is time-consuming to make sure that all students are on task because it is easy to not be on task using Chromebooks. I also feel that young children need to grow their fine motor skills by holding a pencil, and they need to understand "concepts of print" by reading paper books. The pros are that I can have students read and record themselves using Seesaw, allowing me to monitor their independent reading on a level I could not do before technology. Technology also allows us to do research more thoroughly and quickly than in the past. Understanding the validity of sources is a con when doing research.

3. What kinds of technology tools do you find helpful post-COVID-19? If so, how did you use them in the classrooms?

    I use Chromebooks daily because they allow the students to access a variety of learning resources like Lexia Core5, which helps build phonemic awareness, phonics, and reading skills. I also have the students use Seesaw because I can tailor the lessons on Seesaw to match my current curriculum. We use the devices during center time when I teach reading in small groups so that the children have an engaging activity that is quiet when I am working with small groups. However, they only spend 30 minutes on the Chromebooks daily because I also have them rotating through centers that have them practicing cutting, writing, drawing, and reading books.

4. Did you find those technology tools helpful or harmful to the students' classroom learning?

    Helpful, please see the above answer.

5. Are there resources available at school to provide technology tools for your students to enhance their learning? If there are, what are they? If not, how could your schools secure sufficient technology resources for your students?

    We have enough resources for my grade level.

6. What will the future hold for the role of technology to enhance student learning in your classroom?

I have a feeling that technology will change drastically in the future. I feel this way because when I started teaching 20 years ago there were two large desktop computers in my class. I stayed home raising my children for 10 years, and when I returned to the classroom there were 22 Chromebooks and 6 iPads. The future will definitely have more technology, I think it will be more pervasive to have Smart Boards in every class. But, I believe some things will always be essential, like knowing how to hold a pencil, write, and read the old-fashioned way. Our Declaration of Independence is in cursive, so the very foundation of our country is based on our ability to read and interpret the written word.

Seth Interview Questions/Answers: October 12, 2023

1. What is your definition of technology? What technology tools have your students used effectively in the classroom post-COVID-19? And to what extent?

    Technology is anything involving screens, batteries, and/or power. We have effectively used Chromebooks, sound speakers, document cameras, televisions, air filtration, wall phones, printers, wall clocks, electric pencil sharpeners, old school sharpeners, computer charger cases, headphones, outlets, and occasionally phones. With the Chromebooks, we utilize the internet, Google Drive apps, and several programs such as IXL, Newsela, Typing Club, and YouTube. Depending on the assignments we are working on, we might use technology 2 to 4 hours per week.

2. Are there pros and cons to using technology in the classroom?

    Pros: access to enormous resources, ability to differentiate student learning, students like using Chrome Books. Good for repetitive drills and practicing skills.

    Cons: Potential misuse of technology (cruising the web, looking at inappropriate content) can distract some students. Bad for trying to teach new content from internet tutorials. Only a handful of 6th grade students learn directly from web-based programs/apps.

3. What kinds of technology tools do you find helpful post-COVID-19? If so, how did you use them in the classrooms?

    The best use is for research and practicing skills in which they already have a background. We use Newsela 2x per week to read interesting articles and practice reading comprehension questions. This application/website allows students to choose the appropriate lexile level for reading and also has high-interest articles. We also use IXL to practice skills that they have already learned. Also, Google I use Google Classroom in order to assign some assignments and some final drafts are turned in through Google Classroom. I do not use it for all assignments. Also, Google Slides can be an interesting and productive way to create presentations and slide shows.

4. Did you find those technology tools helpful or harmful to the students' classroom learning?

    Overall, they are helpful. They allow us to be more in-depth and have immense resources to pull from. The document camera is surprisingly useful because students can easily see anything that I write, and I can do everything in notebooks rather than writing on a dry-erase board and erasing it.

5. Are there resources available at school to provide technology tools for your students to enhance their learning? If there are, what are they? If not, how could your schools secure sufficient technology resources for your students?

   Overall, Linscott has sufficient resources. They are the Chrome Books and various programs I mentioned earlier. Students can check out Chrome Books for home use.

6. What will the future hold for the role of technology to enhance student learning in your classroom?

   Technology in education will continue to become more and more personalized/differentiated. Although I do not think it will work, I imagine some people are developing a world where students will simply log into a portal, and all of their instruction will occur via AI. The program/intelligence will constantly monitor student understanding and assign/teach material to the student.

Aimee Interview Questions/Answers: October 22, 2023

1. What is your definition of technology? What technology tools have your students used effectively in the classroom post-COVID-19? And to what extent?

    Technology is almost anything besides books/paper/pens I guess. Definitely computers. My students' technology tools in the classroom post-COVID-19 include Chromebooks, Google Classroom, Google Slide presentations, Google Drawings, Google Docs, and Google Sites (they make a website). These are the most common. Other things I have tried out are letting students make video presentations, and I would love to try podcasting. Unfortunately the school does not have technology that allows students to easily make videos/podcasts. Other forms of technology are sometimes used to support students, such as letting them read a book while listening to someone on YouTube read it aloud, and other IEP things like headphones, voice-to-text, etc. The extent of technology use is medium/high, I would say.

2. Are there pros and cons to using technology in the classroom?

    Yes. Pros include engagement - students enjoy using tech and it helps to motivate them to do projects. Cons include a much higher amount of cheating/plagiarising available to students. They can find any answer online and submit it, without understanding it. Also, they get distracted by the internet and waste time doing random things there instead of the assignment. Another big con is that students who are kinesthetic learners are cheated of the kinesthetic experience of writing by hand, and often that is how they learn. Some students do not learn well using technology.

3. What kinds of technology tools do you find helpful post-COVID-19? If so, how did you use them in the classrooms?

    My speaker to amplify voice is very helpful, I also use a Google slide presentation every day because I try to teach in a way that includes all learners: visual, verbal/auditory, etc.

4. Did you find those technology tools helpful or harmful to the students' classroom learning?

    I think overall helpful for most students. I think tech can be harmful to some students who get distracted.

5. Are there resources available at school to provide technology tools for your students to enhance their learning? If there are, what are they? If not, how could your schools secure sufficient technology resources for your students?

    No. Or if there are I don't know about it. Well, students can get a Chromebook to take home actually, so I'm not sure if that counts. I don't know how the school can get tech resources for students (beyond greater funding). I feel that my lack of prep time makes my own understanding of technological tools limited. I don't have time to learn about

new things students can use. I also do not know how to use many technology tools. I would love to expose students to cool tech tools, but there is no time built into my job to prepare for this. I remember when I worked at a district school, you could request a district coach who specialized in technology, but Linscott does not have access to district coaches.

6. What will the future hold for the role of technology to enhance student learning in your classroom?

I wish I could say technology will help students learn in the future and prepare them for life, but I do not see that happening in the current reality of the education system. There is never enough time or money to create big changes. It would be cool if America had a connection between schools and big tech leaders (and other industries), so instead of importing engineers from other countries, we could grow them here. I do not know why this is not happening. But under the current system, I don't feel we can prepare students for the future, including tech.

Appendix 2

<u>Anonymous 7th & 8th Grade Student Survey Questions</u>

1. Do you believe technology is important to your education?

   Yes   No (94.7% said yes)

2. Do you feel technology is beneficial to your learning?

   Yes   No (86% said yes)

3. Is the technology you use in your classroom help when doing your homework?

   Yes   No (91.2% said yes)

4. After COVID-19, are you using more technology now in the classroom?

   Yes   No (61.4% said yes)

5. When using technology in the classroom, do you feel more confident doing your work?

   Yes   No (86% said yes)

6. Would you like to continue using technology in the future throughout your education?

   Yes   No (96.5% said yes)

7. Is using technology in the classroom distracting when learning the material?

   Yes   No (80.7% said yes)

8. What kind of technology do you feel is most helpful to your learning outcome? List a

   couple of choices, please. (Laptops, computers, typing club, Duolingo, IXL,

   Chromebooks, iPads, calculators, videos, doc cam, and Google Classroom.)

9. In your opinion on technology in the classroom? Is it beneficial to your academic

   success? Please explain.