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Professional Development, Digital Platforms, and Middle School Education During COVID-19

Cynthia Susan Castro
The University of Texas Rio Grande Valley

PROFESSIONAL DEVELOPMENT, DIGITAL PLATFORMS, AND MIDDLE SCHOOL EDUCATION DURING COVID-19

A Dissertation

by

CYNTHIA SUSAN CASTRO

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COMMITTEE MEMBERS

Dr. Pierre Ming-Tsan Lu
Chair of Committee

Dr. Rene Corbeil
Committee Member

Dr. Seokmin Kang
Committee Member

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ABSTRACT

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The COVID-19 outbreak shifted towards online learning, requiring educators and administrators to adapt to new digital platforms and technologies quickly. The purpose of this quantitative study is to examine whether there is a significant difference in the frequency of use of digital platforms among middle schools. Secondly, it explores the relationship between teachers' attendance at professional development sessions and their integration of Nearpod lessons during the pandemic. Lastly, it investigates the relationship between the time campus principals invested in technology-related professional development and teachers' adoption of digital platforms at their respective campuses. Surveys and administrative records were collected from schools within the district to gather data for the research. Ultimately, this research seeks to contribute to a better understanding of the factors influencing the successful adoption of digital platforms during the pandemic and to inform future strategies for professional development and technology integration in middle schools.

Keywords: COVID-19 pandemic, digital literacy, digital platforms, professional development, teacher, technology integration, technology-related professional development

DEDICATION

"Trust in the Lord with all your heart and lean not on your own understanding; in all your ways submit to him, and he will make your paths straight." - Proverbs 3:5-6 (NIV)

I want to express my gratitude to my husband, Heriberto, for enriching my life with your love, support, and encouragement. Without you by my side, I would not have achieved all that I have.

To my children, RJ and Amber, you both inspire me every day to become the best version of myself. Your unbreakable bond and dedication mean the world to me. Your commitment and encouragement gave me the strength to face any challenge or obstacle with determination and courage. I am incredibly blessed to be your mother.

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CHAPTER I

INTRODUCTION

The Every Student Succeeds Act (ESSA) was signed into law on December 10, 2015, to ensure that every student in America has equal access to high-quality education. President Obama acknowledged the impact on teachers and sought to address disparities in academic achievement by implementing comprehensive teacher training programs while maintaining rigorous academic standards. However, this objective can only be adequately fulfilled with focused efforts to sensitize teachers to how technology-supported learning can be harnessed (Lasica et al., 2020). Therefore, continuous professional development remains critical for helping the future, and current educators remain coordinated with evolving trends in contemporary classroom instruction.

Professional development programs offer valuable opportunities for teachers to enhance their instructional practices and improve students' academic success (Lumpe et al., 2012). These programs enable educators to learn new instructional practices and stay abreast of current innovations within education. Professional development extends beyond instruction to students and encompasses sustained skill development and growth in teaching. Through ongoing professional development, teachers can enhance their instructional techniques, learn new teaching strategies, and deepen their understanding of the subject matter they teach (Fairman et al., 2020).

The research focuses on variables related to digital educational platforms in middle schools, especially during the COVID-19 pandemic. It aims to provide insights into the relationships between these variables, shedding light on digital platforms and professional development roles during these challenging times. These questions include: 1.) Is there a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic? 2.) What is the nature of the relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic? 3.) What is the nature of the relationship between time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses?

Educators, regardless of their experience level, can gain immense benefits from ongoing professional growth, and the significance of this development resonates across all tiers of education. According to Lumpe et al. (2012), "teachers' knowledge, skills, beliefs, and attitudes will improve, thereby increasing student learning" (p. 155). The is to provide teachers with up-to-date information on contemporary educational movements and enhance proficiency by implementing technological tools within classroom settings. To accomplish this goal, Bowman et al. (2020) suggest that "one of the most important ways to help teachers use technology more effectively is the provision of professional development" (p. 1).

Teachers define professional development as maintaining certifications, fulfilling continuing education requirements, attending training programs and events, and engaging in learning experiences. Notably, Evans (2019) emphasizes that professional development involves enhancing an individual's professionalism in a lasting manner that surpasses temporary gains - this notion and the significance of professionalism are crucial. As education intersects with a

digital era, the significance of remaining current with educational advancements is pivotal in nurturing educators' professional journeys.

Interwoven with these trends is the emergence of students from Generations I, Z, and Alpha, typically aged between 1 and 27, who are at ease with the electronic devices that have progressed throughout these generations. They are the offspring of Generation Y, the initial cohort born in the digital age. Celik et al. (2021) assert that Gen Yers were the first group to completely adjust to technology in a digital world. This observation holds importance as it suggests that individuals from Generation Y exhibit an unparalleled level of comfort and skill with technological devices. Chisega-Negrila (2022) underscores the influence of information technology and Web 2.0 functionalities in the rise of a generation of "digital natives," adept at adapting to microcontent-rich environments.

These shifts have prompted an educator-student dynamic where students often wield greater technical prowess than their teachers. Educators are reshaping pedagogical strategies to address students' tech-savviness, effectively integrating technology for enhanced teaching and learning. Lasica et al. (2020) state that educators should possess a lifelong learning mindset, demonstrating the capacity to engage with emerging technologies continuously and possess sufficient confidence to learn and utilize them independently. This transformation makes instructional technology a cornerstone of professional development.

Moreover, the global COVID-19 pandemic has instigated a shift in education, necessitating the rapid adoption of online teaching and learning strategies. Abdullah's (2021) research indicates that the COVID-19 pandemic has prompted educational institutions worldwide to adopt effective and cohesive online teaching and learning strategies, further emphasizing the importance of integrating technology in education (as cited in Khatser et al., 2021).

The unforeseen pandemic that reshaped the world transformed the evolution of technology-related professional development. Lawless and Pellegrino (2019) acknowledge that teachers should "become familiar with new methods of teaching in the content areas, learn how to make the most effective instructional use of new technologies for teaching and learning, and adapt their teaching to shifting school environments" (p.575). Despite the passage of time and the availability of technology, the COVID-19 virus did not stand still. Teachers continued to increase their knowledge about technological advancements to provide their students with the best possible educational experience.

This research explores the interconnections between education, technology, and continuous professional development. With the rise of digital-native generations and an ever-evolving technological landscape, teachers are responsible for incorporating technology into their instruction. This was further intensified by challenges brought on by the COVID-19 pandemic.

The Research Problem

Amidst the challenges posed by the COVID-19 pandemic, this research aims to explore the interplay between digital platforms, technology-related professional development, and their impact on educational practices in middle schools. This study seeks to provide insights into equipping educators with the necessary skills to navigate the digital landscape and enhance student learning experiences by investigating the relationships between professional development workshops and digital platform utilization.

Navigation Challenges and Digital Transformation Amidst the Pandemic

During the COVID-19 pandemic, teachers faced several dilemmas that might have impacted their professional development. The research sought to understand the difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic. Specifically, the study explored if there was a significant difference in the frequency of use of digital platforms across ten middle school campuses in the Lower South Texas School District. It also examined what is the nature of the relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic and what is the nature of the relationship between time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses?

The importance of digital literacy in education is becoming increasingly evident as the demand for online and blended learning continues to rise. Although modern technology has made significant advancements, according to Graham et al. (2019), there remains a need for greater clarity on its applications and how it can be used to approach problem-solving in education (p. 241). This is particularly relevant given the substantial increase in demand for online and blended learning (BL) options; however, the authors noted a failure to adequately prepare teachers to meet this demand. Therefore, educators realize that there needs to be more learning communities to provide adequate support for their professional growth as digital teachers. Chetty et al. (2018) suggest that "digital literacy provides an individual with core capabilities to achieve valued outputs in life" (p. 6). Both educators and students can benefit from the importance of digital literacy, regardless of their role.

Utilizing technology in education requires a focus on technology and the quality of instruction. While technology can enhance learning and instruction, it cannot be considered a cure-all; teachers must design and deliver effective instruction to realize its full potential. Thus, combining technology and quality instruction is essential to achieve the desired learning outcomes. Salas-Pilco et al. (2022) mention that "Teachers started delivering lessons using online platforms, even without previous training on online learning modalities" (p. 596). Digital transformation encompasses more than just technology; it transforms how technology is utilized in education. Familiarity with digital technologies can facilitate decision-making by educators and administrators.

By embracing digital processes and technologies, organizations can enhance instruction delivery in 21st-century classrooms, as digital learning cannot exist in isolation within a single campus or department. As Chigon (2015) states, "Teacher educators need to embrace the new pedagogies and model them to their preservice teachers" (p. 486). With the spread of the coronavirus, the importance of incorporating digital processes and technologies became evident, making digital learning platforms an essential component of synchronous and asynchronous classrooms. According to Milligan (2020), employing a combination of synchronous and asynchronous instructional delivery techniques seems to be a successful approach.

Professional Development and Digital Literacy Enhancement

Teachers' experiences and beliefs have been found to affect not only their teaching of technology education but also their assessment practices (Gill & Gill, 2019). A teacher's understanding of technology can often lead to an incorrect interpretation of technology in formal education. Teachers' experiences and perceptions of technology may influence their pedagogical content knowledge.

According to Sprott (2019), "most teachers felt like the majority of their PD was dedicated to compliance-based activities where they just were "following the rules'" (p. 327). Although offered, many do not consistently implement professional development and consider meeting a mandatory requirement a waste of time. Lawless and Pellegrino (2016) report that professional development's effectiveness has been limited to teachers' perspectives without considering the impact on student learning.

The COVID-19 pandemic brought a surge of technological devices and software programs, requiring teachers to learn how to use them. In response, technology-related professional development became a crucial tool for teachers to conduct online classes. Raman et al. (2019) suggest that "teachers must be innovative to integrate the Internet of Things (IoT) in the classrooms in order to make 21st-century education a reality, and they must continue to accommodate the needs of Z generation students." (p. 437).

Investing in technology-related professional development courses emphasizing digital literacy to equip teachers with the skills to use digital technologies in traditional and online learning environments. Research by Barton and Dexter (2020) suggests that formal, informal, and independent professional learning sources can help increase teachers' self-efficacy for technology integration. Participating in these professional development courses empowers educators to improve their teaching techniques and boost student interaction by incorporating digital technologies (Barton & Dexter, 2020).

A lack of learning communities exists in the Lower South Texas School District, which hinders the development of teachers' skills in digital literacy and prevents them from gaining the knowledge and skills necessary for success in the 21st century. Darling-Hammond and Bransford (2017) state, "as demands for deeper and more complex student learning have intensified,

practitioners, researchers, and policymakers have begun to think more systematically about how to improve teachers' learning from recruitment, preparation, and support to mentoring and other leadership opportunities" (Darling-Hammond & Bransford, 2017, p. 1). The increasing complexity of student learning has led to the need for leadership in the Lower South Texas School District to implement a relevant 21st-century vision.

The Texas Education Agency (2022) recognizes the significance of incorporating technology into education, which encourages the use of technology to achieve critical educational objectives statewide. Incorporating such tools inside classrooms allows teachers and learners to access a variety of innovative techniques that dramatically improve learning outcomes. Therefore, imparting knowledge on how best to leverage this resource enables administrators and educators alike to be better equipped to align students' future needs equitably. With these necessary skills acquired, teachers are adequately prepared when integrating technology into day-to-day lessons, ultimately equipping young leaders with vital digital proficiency needed in today's technological age (The Texas Education Agency, 2022).

A growing focus for professional development has been instructional technology. Bernstein (2011) suggests that "the focus should be on both subject-matter knowledge, content knowledge, and pedagogical content knowledge (PCK)" (p. 23). K-12 teachers participate in extensive training throughout their careers, which encourages growth and empowerment and results in their student's academic success. According to Bowman et al. (2020), "PD programs have the potential to change these crucial factors for more positive outcomes" (p. 13). For teachers to provide quality instruction to students, they must receive quality professional development programs. Bowman et al. (2020) study indicates that teachers attending professional development programs are more likely to use instructional technology effectively.

School districts should allocate resources to provide educators with comprehensive technology-focused professional development assistance in the digital era. According to Inan and Lowther (2010), "potential educational benefits of these investments cannot take place unless teachers are prepared to use these computers effectively in their instruction" (p. 938). The foundation of an empowered teacher is quality professional development. Barlow et al. (2014) found it was "important to provide teachers with the physical space and resources required for the innovation, as well as supporting their empowerment through a sense of ownership" (p. 16).

Students today are expected to possess skills beyond academic knowledge alone. Students must have the capacity for teamwork, critical thinking, problem-solving, and communicating effectively, which are essential components of the holistic education approach. Teachers may need more expertise to foster student competencies effectively, making professional development essential. Thus, providing teachers with quality professional development to learn new strategies and teaching methodologies. Chigona (2015) asserts that institutions must ensure all teacher education instructors possess the expertise to fully prepare preservice teachers to teach in today's digital era (p. 489). This enables teachers to provide quality education to help students succeed academically and personally.

Purpose of the Study

The COVID-19 pandemic brought unprecedented challenges to the global education system (Gupta, as cited in UNESCO, 2020). By March 23, nearly 1.3 billion learners worldwide had shifted away from traditional classrooms due to the pandemic's impact (Gupta, as cited in UNESCO, 2020). To ensure continuity, schools turned to digital platforms, necessitating swift

adaptations in teaching methods for the lower South Texas School District grappling with limited technology access.

In response to this context, this study focuses on whether there is a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic within Lower South Texas School District. Specifically, it explores the nature of the relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic. Furthermore, the study investigates what is the nature of the relationship between time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses. These inquiries contribute insights into policy-making and educational technology implementation.

Recognizing professional development's historical significance in educators' growth (Bergmark, 2020), the pandemic mandated an online shift in learning for teachers. Professional development has traditionally emphasized singular events, such as lectures and workshops facilitated by external experts, to support acquiring specific skills and competencies. The COVID-19 pandemic led to a mandate from state and federal governments to shut down schools, which resulted in professional development in an online format. During this period, teachers engaged in technology-related professional development that focused on digital literacy, learning management systems, and various web-based applications to enhance their ability to incorporate digital technologies in the classroom.

To boost teaching staff skills and knowledge, the Lower South Texas School District's Professional Development Department offered 427 technology-related workshops in 2019-20. Compared to the prior fiscal year, which only saw 47 sessions, technology-related workshops

covered classroom management systems, software programs, and learning management systems. These workshops aimed to equip teachers with the knowledge and skills to enhance their teaching strategies online and in person to elevate the quality of education and ensure teachers had an optimal learning experience.

The district took an innovative approach to workshop delivery, offering synchronous and asynchronous workshops to accommodate teachers' accessibility needs. Synchronous workshops allowed teachers to interact directly with facilitators and fellow participants for real-time interaction and quick question-and-answer sessions. On the other hand, asynchronous workshops provided teachers the flexibility to attend training at their preferred pace, allowing them to access training materials and resources without time restrictions. This approach acknowledged teachers' various commitments outside their professional duties, empowering them to engage with content at the most convenient times.

In this way, all teachers were able to gain access to these training resources, ensuring that learning was accessible and adaptive for all. As a result of this method, teachers took ownership of their educational learning, thereby fostering a culture of continuous improvement and technological competence.

In the past, the Lower South Texas School District spent millions of dollars on teacher preparation for current educational trends (Texas Education Agency, 2021). In the 2018-2019 school year, spending on professional development increased by an astounding $3,259,852, an impressive increase compared to prior years. According to the Texas Education Agency's Office of School Finance, this district spent over $14.765,399 in professional development expenditures

and $31,633,741 on capital projects during 2020 alone; since the pandemic, instructional technology spending has seen significant spikes.

For school relief, federal and state governments, various public and private organizations, corporations, and charitable groups provided grants to schools to cover the purchase of technology needed in classrooms. Herold (2021) noted that an analysis conducted by Edtech Evidence indicated that U.S. K-12 schools spent between 26 billion and $41 billion annually on education technology during the year before the pandemic. Furthermore, during the pandemic, the CARES Act, signed by former President Donald Trump, provided school districts with $13.2 billion, and the American Rescue Plan Act, signed into law by President Joe Biden district got another 81 billion in ESSEER III support (Herold, 2021). These acts provided schools with funds for purchasing technology hardware and software necessary for remote and hybrid learning environments. With these grants, all students had equal access to technology, ensuring no student was left behind in their education.

Research Questions

The following questions will be addressed in this study:

1. Is there a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic?
2. What is the nature of the relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic?
3. What is the nature of the relationship between time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses?

Null Hypothesis

$H1_0$: There is no significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic.

$H2_0$: There is no significant relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic.

$H3_0$: There is no significant relationship between the time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses.

Research Hypothesis

$H1_a$: There is a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic.

$H2_a$: There is a significant relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic.

$H3_a$: There is a significant relationship between the time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses.

Objectives

Main objective. The main objective of this study is to investigate the usage of digital educational platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic and assess the impact of professional development on the integration and adoption of these platforms.

Secondary objective. First, determining whether there is a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic. Second, assessing the nature of the relationship between teachers' professional development attendance and the integration of Nearpod lessons during the pandemic. Last, analyzing the nature of the relationship between the time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses.

Justification of the study

The justification behind this study stems from the need to understand the profound implications of the COVID-19 pandemic on both professional development and digital learning platforms within the Lower South Texas School District. The quick transition to remote learning necessitated rapid adjustments by educators and students as they adopted unknown digital educational platforms and innovative teaching methodologies. Through a comprehensive investigation, this study attempts to determine is there a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic. Moreover, what is the nature of the relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic, and what is the nature of the relationship between time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses?

This study also examined the relationship between the number of hours of campus principals' technology-related professional development and the utilization of digital platforms

on their campuses during the pandemic. The findings from this study may offer valuable insights into the difficulties and possibilities associated with digital education and professional development. The results could further influence the development of future digital education strategies and professional development programs in the district and beyond.

Technology-related professional development can effectively support individual teachers' professional learning if it allows for social educative engagement with other professionals and is adaptable to the learner's specific context (Parsons et al., 2019). This interactive method promotes the creation of settings, enabling teachers to engage in meaningful discussions, exchange valuable teaching methods, and gain valuable insights from various viewpoints. Additionally, tailoring development opportunities to meet the needs of educators in their classrooms enhances their capacity to effectively utilize new techniques and strategies, ultimately leading to improved student learning outcomes.

Being equipped with professional development skills and knowledge regarding technology, content, and pedagogy is integral to teacher effectiveness in the classroom. According to Ross (2020), technology usage in K-12 classrooms is anticipated only to increase as more advanced products enter the market and as students and teachers become reliant upon it for daily lives (p. 15). Technological advances impact student learning as it becomes an integrated component of our lives; competencies for teaching do not consist solely of basic abilities but include new skill sets as well.

This research intends to provide middle school core subject teachers with an understanding of the impact of technology-related professional development on teaching practices. The findings of this study may also be helpful to current and future teachers and district leaders, who can use the results to improve their technology-related professional

development programs. This study aims to assess teacher perception by analyzing survey data, which can provide valuable insights to district leadership on the effectiveness of professional development and the future use of digital platforms. Finally, the study can help the district evaluate the leadership on campus and assess the available resources to support campus leaders.

Definitions of terms

This study places considerable importance on the following terms. The researcher aims to provide clear definitions, descriptions, and meanings of these terms as they relate to the study.

COVID-19 pandemic: A severe respiratory illness caused by the Coronavirus disease that spread throughout 2019 and is ongoing. According to the World Health Organization (2021), "COVID-19 is a pandemic, a disease caused by SARS-CoV-2 that emerged in humans in December 2019, spreading globally to cause a worldwide pandemic."

Digital literacy: the ability to navigate and interpret information online or in electronic format and communicate it. Hobbs and Coiro (2019) define "digital literacy" as an expanded conceptualization of literacy that is responsive to the ongoing changes in information and communication technologies that are part of everyday life (p.402).

Digital platforms: online tools that help students, teachers, and administrators interact and share educational resources, assignments, and feedback.

Professional development: the continuous process of acquiring new knowledge, skills, and competencies that educators and staff undertake to improve their teaching and stay current with educational trends.

Teacher: an individual responsible for facilitating learning and imparting knowledge and skills to students.

Technology integration: the use of technology-based resources and practices in schools.

Technology-related professional development: A type of training offered to teachers in public education, whether synchronously or asynchronously. To instruct students remotely, teachers were required to attend online professional development workshops. Teachers were required to learn a classroom management system and a communication platform.

CHAPTER II

LITERATURE REVIEW

The literature review presents a comprehensive analysis of the background and problem statement of the study. This review identifies articles related to professional development for teachers, highlighting the importance of acquiring new skills that will help educators keep pace with technological advances and educational trends. The following sections provide an overview of theoretical frameworks and relevant research articles, including (1) the historical background of professional development, (2) the theoretical framework, and (3) the relevant research. This comprehensive approach deepens the understanding of the current state of professional development and lays the foundation for the subsequent sections of the study, contributing to the research's overall rigor and scholarly significance.

Understanding Professional Development in Education

Professional Development for teachers can be traced back to its origins in teacher education. Since its emergence, professional development has played an invaluable role in shaping educators' skills and knowledge. As education and training become ever-more crucial in today's globalized environment, professional development has become an indispensable element of the field. Buyse et al. (2009) emphasize that teacher professional development is widely recognized as the most effective means of equipping new practitioners with the necessary tools

and improving instructional and intervention practices when they enter the workforce. To ensure teachers remain current with content knowledge, teaching strategies, and information on upcoming educational developments, they must participate in ongoing professional development opportunities.

As the field of education evolves, so too do its demands and expectations on teachers. Experienced teachers benefit from ongoing professional development opportunities to build upon existing skills, adopt innovative pedagogy approaches, and keep abreast of research and innovation in their subject area. Liu and Phelps (2020) state that " teachers are more likely to sustain their knowledge after attending PD programs with longer duration and ongoing activities over time" (p. 545). Therefore, continuous learning and growth benefit teachers personally and have an enduring positive effect on the quality of education provided to their students.

Teacher Innovation, Practical Experiences, and Professional Knowledge

Traditional professional development practices involved reading handouts and books on teaching methods, observing teacher modeling, and discussing effective classroom practices during meetings. However, research by Barlow et al. (2014) suggests that not all forms of professional development have proven effective (Barlow et al., 2014). In the past, conferences often occurred in open spaces where some participants had to stand or sit on the floor. Over the decades, there has been an evolution in understanding of how educators learn and what constitutes effective professional development (Martin et al., 2017). The focus has shifted towards more dynamic, interactive, research-based, and personalized approaches to meet teachers' diverse needs.

Professional development extends beyond the teaching profession itself. Tantawy 2020) argues that teacher innovation in professional development stems from educators' practical

experiences in the classroom and their ability to create instructional strategies that foster autonomous, reflective, and critical thinking skills among their students. By continually expanding their professional knowledge, teachers are better equipped to meet the diverse needs of their students and provide quality education. Van As (2017) stresses the importance of teachers building their professional knowledge. This includes increasing their knowledge of the school context and developing subject expertise and effective pedagogical strategies.

Overall, professional development embraces innovative approaches, draws on teachers' practical experiences, and prioritizes the continuous expansion of professional knowledge. By doing so, educators are better equipped to stay current with evolving educational trends, implement effective teaching strategies, and contribute to improving student outcomes. In this way, professional development serves as a foundational element in advancing both the practice of teaching and the field of education.

Importance and Evolution of Professional Development

In the landscape of education, professional development plays a pivotal role in ensuring that teachers remain competent and effective throughout their careers. According to de Groot-Reuvekamp et al. (2018), when it comes to the pedagogy of teaching, teachers need to develop their skills by engaging students in learning activities that align with their students' development stages. Thus, continuous learning enables teachers to adapt quickly to changing teaching approaches, instructional technologies, and educational policies. By actively engaging in professional development opportunities, teachers acquire new knowledge, refine their skills, and stay updated on the best practices in their respective fields. This enables them to provide students with the highest-quality education possible, equipping them with the necessary tools to thrive in an increasingly complex and interconnected world. Martin et al. (2010, as cited in Koh, Chai, &

Lim, 2017) emphasized that professional development programs need to consider how they influence student outcomes.

Throughout history, professional development has been defined as acquiring or maintaining professional certifications, such as completing continuing professional hours for licensure, participating in content-specific training, attending conferences and seminars, and engaging in various learning opportunities. As teacher training has changed, its scope and methods have expanded, and there has been an increased emphasis on professional development. Research conducted by Sancar et al. (2021) indicated that teacher education played a vital role in professional development, with ongoing professional development programs ensuring that teachers possess the necessary knowledge and skills to meet the demands of 21st-century students. Evans (2014) previously defined professional development as "an ongoing process whereby individuals' professionalism may be increased through an enhanced quality of service that exceeded temporary needs" (p. 188).

Teachers enhance their expertise by actively pursuing professional development opportunities and staying current with educational developments and research. Tantawy (2020) defined teachers' professional development as the "re-establishment, development, and expansion of teachers' knowledge and skills" (p. 182). This commitment to staying up-to-date enables teachers to grow and improve continuously, ensuring that they are equipped to meet the diverse needs of their students and provide them with the best possible education.

The Role of Instructional Technology and Digital Literacy

Teachers recognize that traditional teaching methods might have been less successful in an online environment due to screen fatigue experienced by students. Teachers tried various approaches, such as chunking lessons to maintain students' interest. Furthermore, they turned to

instructional technologies that provided opportunities for engaging students through integrated activities. Multiple digital platforms enable teachers to design engaging lessons, offering a range of features that include real-time assessments, interactive simulations, and collaborative activities. Hover and Wise (2022) argue that the adoption of "flexible and adaptive digital tools are needed to create personalized learning paths for students who are beyond grade-level expectations and to give teachers time to address the needs of struggling students" (p. 42). Adopting these technologies required additional professional development endeavors to ensure teachers had the expertise to leverage such digital tools effectively.

This disruption led to increased instructional technologies in residential and educational settings. As a result, there has been an increased focus on digital literacy to promote distance learning. Research by Oberer and Erkollar (2018) suggests that it is necessary to develop inventive methods that can extract worth from digitization. Therefore, due to the quantifiable value of technology as an instructional tool during the pandemic, it is intended that teachers receive training to provide instruction that will contribute to students' academic success.

Overall, instructional technology and digital literacy were indispensable in combatting online learning challenges and encouraging student engagement. An adaptive digital tool was identified to meet grade-level expectations while meeting the needs of struggling students, necessitating additional professional development efforts to equip teachers to use this tool effectively. COVID-19's disruptions caused by its pandemic triggered an upsurge in digital literacy awareness and education, prompting educators to find creative methods of using instructional technology's potential to enhance learning outcomes while simultaneously preparing their students for a rapidly transforming digital environment. Educators utilized

instructional technology's potential by providing comprehensive training and support services while equipping their pupils for future digital realities.

Professional Development and Technological Adaptation

Instructional technology is an area that has increasingly become a focal point for professional development. The knowledge and skills that students acquire in class are greatly influenced by the abilities and knowledge of their educators (Van As, 2017). The development of teachers' skills in technology is essential for their growth as professionals, as it may significantly impact their self-esteem, self-efficacy, and general classroom skills. For teachers to be successful in their roles as educators, quality professional development programs are essential. Van As (2017) suggests, "high-quality professional development should immerse participants in inquiry, questioning and experimentation, and act as a model for inquiry forms of teaching (p. 422).

Developing professional skills strategically can help teachers become more effective in their profession. Lawless and Pellegrino (2016) suggest that "there needs to be a clear articulation of the intended outcomes of professional development, and appropriate evaluation strategies must be implemented to assess them" (p. 580). As instructional technologies progressed during the pandemic, various technologies could be used to deliver professional development in synchronous and asynchronous modes. Milligan (2020) suggests that "offering both synchronous and asynchronous delivery appears to be an effective instructional strategy" (p. 3209).

In summary, by investing in high-quality professional development programs and leveraging instructional technologies, educators can enhance their instructional practices, promote student engagement, and contribute to improved learning outcomes. The continuous development of teachers' skills in instructional technology is crucial for adapting to evolving

educational landscapes and preparing students for the challenges and opportunities of the digital age.

The Current State of Professional Development in Education

Professional development in today's rapidly advancing educational landscape is critical for educators to stay current with emerging approaches and methodologies that address diverse student needs. "Teachers joining the teaching professional from teacher training would be exposed to the pedagogical shift, hence be adequately prepared to teach" (Chigona, 2015, p. 479). Educators can enhance their teaching abilities, broaden their knowledge base, and refine instructional practices through professional growth opportunities. By prioritizing professional growth and development, they can foster meaningful learning experiences that prepare their students for success in an ever-changing world.

Professional Learning Communities

Professional learning communities (PLCs) have become a prevalent feature of professional development in education. According to Chen (2020), "the integration of PLC activities with other professional development efforts creates added value for PLCs by reducing teachers' workload in mandated teacher professional development activities, thus enhancing their willingness to devote their time and efforts to PLC activities and sustain their implementation" (p. 382). These communities consist of educators who engage in shared learning experiences, reflect on their practice, and exchange ideas and best practices. Professional learning communities foster collaboration, promote a culture of continuous improvement, and provide opportunities for peer support and feedback.

Through dialogue and shared reflection, educators can critically examine their instructional strategies, identify areas for improvement, and explore novel teaching and learning methods. As Schlosser et al. (2021) suggested, professional learning community members (PLC) can discuss student growth and explore evidence-based strategies to enhance student achievement of learning objectives. This reflective process fosters individual development and adds to the collective knowledge and expertise of the community. Their open and collaborative structure encourages professional dialogue, leading to the co-construction of knowledge and the dissemination of best practices. With such communities at their disposal, educators can leverage the collective wisdom of members of such groups to meet specific needs, explore innovative instructional methods, or adapt teaching practices to meet student diversity better.

In conclusion, professional learning communities provide an exciting and interactive platform for professional development in education. By encouraging collaboration, reflection, and knowledge-sharing among educators in collaborative learning communities, instructional practices are improved along with student outcomes. By actively participating in these communities, educators can improve their teaching techniques while contributing to the advancement of their profession.

Workshops and Conferences

Workshops and conferences provide educators with additional opportunities for professional growth within education, providing an opportunity to attend presentations, workshops, and interactive sessions facilitated by subject matter experts. Kaye et al. (2011) suggest that professionals possessing both subject expertise and practical implementation skills should guide professional development workshops (PDWs) within learning communities (LCs). These facilitators interact with participants of these PDWs to ensure the appropriate use of

knowledge within local contexts. These events cover various topics related to curriculum design, assessment strategies, classroom management, and instructional technology. Furthermore, these events offer a platform for networking, exchanging innovative ideas, and keeping up-to-date on education trends.

One of the key benefits of attending workshops and conferences is the opportunity for professional growth and development. According to Kaye et al. (2022), educators who participated in professional development workshops experienced significant enhancements in their knowledge, skills, and self-efficacy. Educators have the opportunity to stay updated on the latest research and best practices in teaching and learning, acquiring fresh perspectives that can enhance their instructional strategies. Through active participation in interactive sessions and hands-on activities, educators can effectively apply their newfound knowledge and reflect on its adaptation to their unique teaching contexts. Miller et al. (2022) emphasize that workshop faculty participants gain valuable skills to improve their courses, including creating a positive learning environment, employing effective teaching strategies, addressing diversity and inclusion, and enhancing student success and belonging.

Additionally, workshops and conferences foster collaboration and networking among educators. Ehman et al. (2021) state workshops are dynamic approaches where participants create and present their own content. This enables participants to share specialized knowledge within a specific aspect of their professional practice. These events bring together professionals from diverse backgrounds and educational settings, providing a unique opportunity for exchanging ideas, insights, and experiences. Ehman et al. (2021) suggest that “these events are a great way for members to network and meet both new and old friends in a low-stress and fun environment” (p. 5467). Educators can participate in discussions, exchange triumphs and

difficulties, and establish a network of supportive colleagues who inspire and assist them throughout their professional journey. The connections fostered at workshops and conferences can pave the way for future collaborations, partnerships, and enduring professional relationships, ultimately leaving a significant imprint on educational practice.

Furthermore, a workshop or conference catalyzes innovation and change in education. According to Mishra et al. (2019), teachers gained an understanding of the role of technology and its effective implementation in the classroom by overcoming obstacles through first-hand experience with technology during the workshop. The objective of these conferences is to provide educators with a forum for exploring emerging trends, technologies, and pedagogical approaches that have the potential to transform teaching and learning. Educators can discover cutting-edge tools and resources that enhance student engagement and achievement by attending instructional technology sessions. Keeping abreast of the latest research trends within education would allow educators to adapt their practices to meet the shifting needs of their students and communities.

Online Courses and Webinars

Online courses and webinars have gained significant traction in professional development for educators. According to Chetty et al. (2018), "digital literacy also enables one's participation in social networks for the creation and sharing of knowledge, and the ability supports a wide range of professional computing skills" (p. 6). These digital platforms provide flexible and accessible options for teachers to engage in self-paced learning and acquire new knowledge and skills. Powell and Bodur (2019) indicate an increasing utilization of online teacher professional development (OTPD) to address education concerns. OTPD offers flexible, cost-effective, and wide-scale options for educators to explore various educational topics.

Furthermore, online courses and webinars promote interactive learning experiences. Ramirez-Montoya et al. (2021) state that "these modalities are considered to diversify teacher training and facilitate new ways to manage, evaluate, and motivate learning through virtual environments" (p. 14). Many platforms incorporate discussion forums, virtual collaborations, and multimedia resources to engage educators actively. Additionally, these interactive components enable educators to connect with fellow teachers from different locations, share insights, and exchange best practices. Lammers and Astuti (2021) note that online platforms such as webinars, virtual professional gatherings, Facebook and Instagram live sessions, and various other discussion forums serve as mediums for communication and engagement. Through online discussions and collaborative activities, educators can explore diverse perspectives, engage in critical thinking, and broaden their understanding of educational concepts and strategies. The interactive nature of online courses and webinars fosters a sense of community among educators, creating opportunities for networking and building professional relationships that extend beyond geographical boundaries.

Integrating technology in online professional development enables educators to enhance their digital literacy skills, explore new instructional technologies, and gain confidence in effectively utilizing them in their classrooms. Lammers and Astuti's (2021) study on digital literacy highlights the valuable insights gained from this shift, commonly referred to as the digital turn, which emphasizes the significant role of technology in facilitating activities such as reading, writing, language acquisition, and various other forms of literacy engagement. By embracing technology-enabled learning, educators can remain current with the latest advancements and adapt their teaching practices to meet the evolving needs of their students in the digital age.

Peer Coaching and Mentoring

Peer coaching and mentoring have emerged as practical approaches for supporting educators' professional growth. According to Porras et al. (2018), peer coaching created a supportive and secure environment for teachers, allowing them to explore alternative strategies without the burden of evaluation. Through one-on-one or small group interactions, coaches and mentors provide teachers with personalized guidance, feedback, and support. As stated by Porras et al. (2018), “peer coaching is a process in which two or more teachers work towards a specific and determined purpose in order to improve and validate their practices in the classroom” (p.174). Peer coaching and mentoring relationships focus on specific goals or areas of improvement identified by the educators. These personalized interactions foster reflective practice, encourage experimentation with new strategies, and promote ongoing professional growth.

Peer coaching and mentoring also promote a collaborative and supportive culture within the educational community. By establishing a mentorship program or implementing coaching initiatives, schools and districts create structures that encourage the sharing of expertise and the development of a learning community from a colleague who is more experienced. As stated by Porras et al. (2019), “the mentee gains valuable knowledge from a colleague who is more experienced.” (p. 173). Therefore, experienced educators can serve as mentors, sharing their knowledge and insights with less experienced teachers. This collaborative approach supports the professional growth of individual educators and contributes to the overall improvement of instructional practices within the institution. Additionally, coaching, and mentoring relationships often extend beyond the initial goals, with mentors becoming advocates for their mentees and providing ongoing support throughout their careers.

Professional development programs incorporating coaching and mentoring have significantly positively impacted teacher efficacy, instructional practices, and student outcomes (Johnson et al., 2017). Peer coaching, as highlighted by Johnson et al. (2017), offers a professional development framework that recognizes the increasing importance of hands-on and active methodologies in enhancing teaching effectiveness and classroom environments. The personalized nature of coaching and mentoring enables targeted support tailored to the specific needs of individual educators, resulting in more effective professional development outcomes. Johnson et al. (2017) further emphasize that peer coaching uniquely fosters collaborative and supportive peer relationships (p. 463). By prioritizing coaching and mentoring as integral components of professional development initiatives, educational institutions can foster a culture of continuous improvement and empower educators to maximize their potential.

The Future of Professional Development in Education

Instructional technology has quickly become a primary area of professional development. Extensive training provided to K-12 educators aims to promote growth and self-efficacy, with the intention that these improvements will reflect in student academic success. Professional development focuses on enhancing teacher development to improve student outcomes. It is recognized that there is not a one-size-fits-all method, as educationalists understand that learners have diverse learning styles. A cookie-cutter approach to professional development is not the future. "Emergence of electronic educational resources based on distance, mobile learning, and cloud technologies has led to the expansion of opportunities for basic and additional education, lifelong learning, and the enhancement of general and professional competencies of future teachers" (Sharov et al., 2019, p. 1469).

The development of innovative technologies and the ongoing evolution of educational practices have prompted the exploration of potential future directions for professional development in education. With a greater emphasis on personalized learning and the need for flexible learning environments, educators are now considering innovative approaches to delivering educational content.

Personalized and Adaptive Learning

The future of professional development in education is expected to place greater emphasis on personalized and adaptive learning approaches. Aeiad and Meziane (2019) researched the "Adaptable and Personalised E-Learning System (APELS)," which aims to expand the current understanding and utilization of conventional e-Learning systems by utilizing freely available web resources to design and deliver content tailored to individual learners (p. 1486). Advancements in learning analytics and artificial intelligence have enabled educators to gather data on learners' strengths, weaknesses, and preferences. These insights can be leveraged to customize professional development programs according to the specific needs of educators, fostering their growth and improvement (Aeiad & Meziane, 2019). Educators can provide content that aligns more effectively with learners' unique learning styles, backgrounds and needs by incorporating personalized learning environments.

Furthermore, adaptive learning platforms offer educators a range of personalized features, including recommendations, resources, and assessments based on their progress and performance. According to Liu et al. (2017), "these systems can add value to the learning experience by presenting information in understandable and engaging ways that are situated in relevant and meaningful contexts personalized to the student" (p. 1607). These platforms utilize algorithms to analyze data and adjust the learning experience to suit each educator's needs, pace,

and learning style. Liu et al. (2017) indicate that navigation in adaptive learning is customized according to the learner's knowledge or academic level, employing an online rule-based decision-making algorithm. Adaptive professional development enhances learning efficiency and effectiveness, facilitating continuous feedback and ongoing adaptation aligned with the individual educator's development trajectory.

In conclusion, integrating personalized and adaptive learning approaches can bring transformative changes to the professional development landscape in education. These advancements empower educators to deliver tailored and compelling learning experiences, fostering professional growth and benefiting student achievement and success. With ongoing advancements and innovative applications in the field, the future of professional development in education is poised to maximize individualized learning experiences and enable educators to thrive in a dynamic and evolving educational landscape.

Blended Learning and Microlearning

Blended and online learning platforms are poised to play a significant role in the future of professional development. Blended learning combines online educational content with the interactive nature of classroom instruction, resulting in personalized learning experiences for groups of learners (Tuan et al., 2022). These platforms offer flexibility, convenience, and accessibility, enabling educators to engage in professional development activities at their own pace and schedule. The blended learning format is considered cost-efficient for participants, as it saves them time and money on travel expenses (Poelzl-Stefanec et al., 2023). Additionally, they provide opportunities for collaborative learning and networking, allowing educators to connect and share best practices with colleagues from diverse backgrounds.

With advancements in immersive technologies, microlearning has emerged as a highly effective approach to professional development. It offers a new and innovative way to deliver educational content to learners by breaking down information into short, focused bursts or modules. According to Chisega-Negrila (2022), "Microlearning courses contain chunks of information that address specific learning needs and are focused on a specific topic, a feature which makes them more suitable and popular for lifelong, personal, and corporate learning" (p. 8). These courses provide educators with targeted and easily digestible information, enabling efficient and time-effective learning experiences.

Microlearning is expected to play a prominent role in professional development, offering a flexible and practical approach to delivering educational content to learners. It allows educators to deliver instruction in short and focused bursts, ensuring a longer attention span from teachers. Microlearning has evolved into a new instruction delivery method with its emphasis on addressing specific learning needs and delivering information in bite-sized chunks. Chisega-Negrila (2022) defines microlearning as instructional courses developed and administered through agreements between organizations or departments seeking to train their employees and other entities responsible for creating and delivering the course content. This approach allows for personalized and efficient learning experiences, meeting the demands of lifelong, personal, and corporate learning.

Rationale

The professional development programs available to teachers offer invaluable opportunities for them to acquire new skills, stay updated with teaching methodologies, and explore innovative technologies that can be integrated into their classrooms (Barton & Dexter, 2020). These programs enhance teachers' abilities and contribute to their self-confidence as they

integrate new techniques and tools into their instructional practices. Teachers can explore innovative ideas and approaches with increased self-assurance, ultimately improving student outcomes.

With the advancement of technology, teachers can create captivating and interactive learning experiences customized to their student's individual needs and preferences. This includes developing videos, podcasts, quizzes, simulations, and other engaging content. These digital tools also make it easier to create presentations. Educators gain hands-on experience with these resources by participating in development programs and receiving training on using them effectively. This active involvement equips them with the knowledge and skills needed to provide instruction that caters to diverse learning styles and abilities. As a result, educators enhance their teaching capabilities, stay updated on research and trends, and establish more dynamic and tailored learning environments for their students.

Participation in professional development programs is beneficial for the growth and advancement of teachers as educators. Isac et al. (2022) emphasize the significance of teacher collaboration and learning in incorporating education for sustainable development. They argue that such collaboration substantially fosters a shared sense of dedication, develops a mutual understanding of sustainable development concerns and pedagogical approaches, and cultivates a sense of efficacy. In addition to acquiring new teaching skills, teachers gain confidence, enabling them to experiment with innovative teaching methods and digital tools in their classrooms. As their knowledge expands, they become better equipped to meet the diverse learning needs of their students, ultimately enhancing the overall learning experience.

Theoretical Context

Technological Pedagogical Content Knowledge Framework (TPACK)

The Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra and Koehler, is the foundation for this research study. This framework builds upon Lee Shulman's construct of pedagogical content knowledge (PCK) by incorporating technology knowledge into it. TPACK offers a systematic structure to enhance teachers' ability to integrate technology, bridging the traditional teacher education approaches centered on pedagogical content knowledge (Cochran, 1991, as cited in Voithofer et al., 2021). The absence of technology in PCK was attributed to the limited visualization of technological tools at that time, as explained by Mishra and Koehler (2006).

Amidst the rising use of digital technologies in education, the COVID-19 pandemic has brought greater significance to technology integration. When designing instructional activities, equal attention must be given to technology, pedagogy, and content knowledge, as the TPACK framework emphasizes. According to Chigona (2015), "TPACK was developed to assist teachers in identifying the nature of knowledge for technology integration in their teaching" (p. 481). Through TPACK, educators can adopt a new perspective on technology and comprehend its integration into teaching practices.

Beyond implementation, the TPACK model not only provides teachers with a framework for implementing technology in their classrooms but also provides a model for continuous improvement that they can utilize to reflect on the relationship between technology, pedagogy, and knowledge and how that relationship changes over time. Beyond implementation, the TPACK model offers a means for continuous improvement, enabling reflection on the dynamic

relationship between technology, pedagogy, and knowledge over time. As outlined by Chigona (2015), there is now an expectation that newly qualified teachers should possess the ability to integrate technological, pedagogical, and content knowledge (TPACK) and effectively teach in the digital age.

Facilitating the incorporation of technological tools into instruction is one of the primary objectives of using the TPACK model, which serves as an instructional design framework for emphasizing such approaches meaningfully and cohesively across all spheres of academia. Harris and Hofer's research (2017) demonstrates that using TPACK as a framework for professional development assists educators in perceiving their curricula from a fresh perspective, enabling them to recognize technologically enhanced approaches that cater to their students' diverse learning requirements.

Educators following this framework are empowered by acquiring new knowledge about improving content delivery methods and pedagogical approaches and nurturing their technical skills for achieving favorable student learning outcomes. The TPACK model's adaptability across diverse domains makes it an invaluable tool for researchers wishing to study the intersection between technology and subject matter competence.

However, for teachers to effectively implement the TPACK model, they need access to high-quality technology-related professional development programs. These programs should focus on developing the skills and knowledge required to effectively use technology in their teaching practices. As Van As (2017) suggests, professional development programs should include both skills development and an improvement of content knowledge. This is necessary to prepare and equip teachers for the changes required in the updated content framework. By

providing teachers with the necessary skills and knowledge, they can better integrate technology into their teaching practices, resulting in improved learning outcomes for their students.

Keeping up with current trends in education through professional development is important for teachers, as it can help them create engaging and effective learning experiences that support the success of their students in the classroom. Teachers' worldviews are the key to understanding what it means to be or not to be a teacher in a digital society (Tsybulsky & Muchnik-Rozanov, 2021). It is widely accepted that educators must be familiar with technology to prepare for 21st-century classrooms. Recognizing the importance of technology for 21st-century classrooms, teachers must possess relevant content knowledge, pedagogical knowledge, and the associated skills to drive educational reform (Chai et al., 2019).

Essential Principles and Concepts of TPACK

This literature review examines three research sections to evaluate the impact of technology-related professional development on teachers' ability to implement technology in the classroom. The first section introduces the theoretical Technological Pedagogical Content Knowledge (TPACK) framework, guiding research development. Additionally, the literature emphasizes the significance of having a technology-savvy leader on campus who can effectively facilitate the integration of technology into the curriculum. Given the nation's focus on enhancing student achievement and preparing them for a technologically driven future, all K-12 schools are mandated by the U.S. Department of Education (2019) to integrate technology. The final section explores how teachers can utilize the TPACK framework to effectively integrate technology into the classroom for instructing 21st-century students.

Understanding the Components of TPACK Framework

To effectively integrate technology into the classroom, teachers require a deep understanding of the subject matter, known as content knowledge. Additionally, they need to know effective teaching methods and techniques to facilitate student learning, referred to as pedagogical knowledge. Familiarity with digital tools and devices that can be used in the classroom to enhance teaching and learning is known as technological knowledge. The ability to combine and apply these three types of knowledge (content, pedagogical, and technological) to create effective learning experiences for students is TPACK integration.

Understanding the classroom environment, student characteristics, and the lesson or curriculum's goals are critical and contextual factors. Teacher professional development is also crucial to TPACK, as teachers require training and professional development opportunities to develop and refine their TPACK skills. Lastly, TPACK is a concept that requires teachers to continually learn and adapt to new technological advancements and changes in teaching methods, emphasizing the importance of continuous learning.

According to Mishra et al. (2019), professional development workshops effectively enhance teachers' technological efficiency and motivate them to incorporate technology into their teaching. This was particularly significant during the COVID-19 pandemic, where remote learning had become a norm, and teachers have had to adapt to technology to ensure continuity of learning for their students. Therefore, integrating technology into their teaching has become more critical than ever before.

Incorporating technology into teaching requires teachers to merge their pedagogical and content knowledge with technological components, as shown in Figure 1. This framework represents an extension of Shulman's PCK theory, highlighting the essential role of technology in

teaching and emphasizing the importance of teacher professional development in utilizing technology effectively in the classroom.

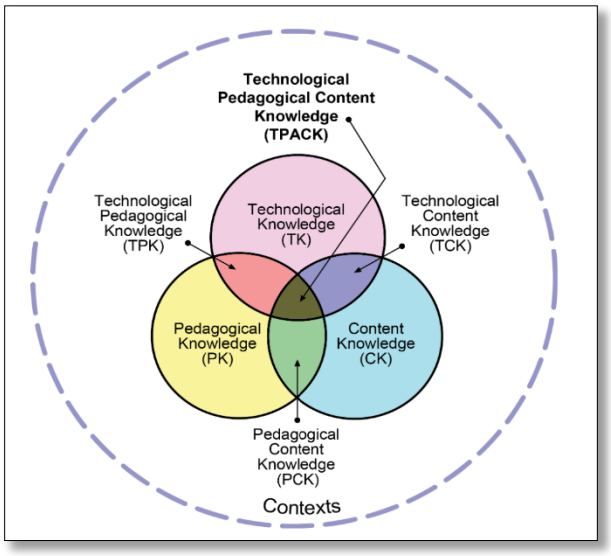

Figure 1: *Technological pedagogical content knowledge (TPACK, 2022)*

A diagram of the Technological, Pedagogical, and Content Knowledge Framework is presented in Figure 1. TPACK consists of seven components:

1. **Content Knowledge (CK)** – A teacher's understanding of the subject matter to be taught or learned.
2. **Pedagogical Knowledge (PK)** – The knowledge of teaching and learning processes and practices that teachers possess.
3. **Technology Knowledge (TK)** – Understanding how technology works and how to work with its tools and resources.
4. **Pedagogical Content Knowledge (PCK)** – An understanding of pedagogy related to content teaching by Shulman's conception.

5. **Technological Content Knowledge (TCK)** – Understanding the relationship between technology and content.
6. **Technological Pedagogical Knowledge (TPK)** – The understanding that teaching and learning can be affected by using certain technologies in certain ways.
7. **Technological Pedagogical Content Knowledge (TPACK)** – This knowledge underpins the effective and highly skilled use of technology in teaching.

Evolution of TPACK: A Historical Perspective

The COVID-19 outbreak created numerous challenges globally, and teachers often encountered difficulty when teaching their classes. One such difficulty involved how teachers provided instruction. As technology becomes more ubiquitous in education, professional development opportunities related to this topic have also increased to assist teachers in using it effectively in instruction. Thus, instructors of these remote workshops must utilize both their pedagogical content knowledge and technological understanding in their teaching approach. To meet this objective successfully, it is necessary to revisit and examine the works of Shulman, Koehler, and Mishra. Shulman (2013) defines content knowledge as understanding that extends beyond facts or concepts. Teachers must be able to explain why concepts are necessary and related, both theoretically and practically within and beyond education. According to Shulman's definition in 2013, content knowledge refers to both the quantity and arrangement of knowledge present within a teacher's mind.

Furthermore, he explains that pedagogical knowledge is the second kind of content knowledge. In his view, a teacher must master pedagogical and content knowledge to be considered an expert in a particular field. According to Shulman (2013), pedagogical knowledge extends beyond the mere knowledge of subject matter to encompass the aspect of subject matter

knowledge for teaching. Nevertheless, the pandemic resulted in a significant increase in technology, which made its way into the educational field and left a lasting effect on the delivery of educational content and pedagogy.

The TPACK model, which integrates pedagogical, content, and technological knowledge in supporting student learning through technology, is one model that has seen increasing adoption in teacher preparation and professional development. It is essential for teachers to have proper knowledge of technology and know ways to employ them (Mishra et al., 2019). Shulman defines pedagogical content knowledge as the knowledge teachers use to transform subject matter for their students' learning. In contrast, Mishra and Koehler have built on Shulman's framework, but they relate it to teachers' knowledge regarding integrating technology in the classroom.

Several researchers have tried incorporating technology into Shulman's ideas of pedagogical content knowledge over the years. Mishra and Koehler (2006) proposed that TPACK comprises three basic knowledge forms. Technological knowledge refers to the knowledge of technology and its tools, pedagogical knowledge refers to the knowledge of teaching methods, and content knowledge refers to the knowledge of content. Koh (2020) suggests that technological knowledge and content knowledge result in technological content knowledge, which is one's knowledge of different ways to represent content with technology. According to Hickman (2016), John Dewey was prescient in proposing a pedagogy that was friendly to current initiatives in innovative classroom technology, including inverted or "flipped" classroom projects in the United States.

Teachers today utilize various learning management systems, classroom management systems, and other software applications to engage their students. Learning management systems

are fast becoming one of the most popular classroom strategies because of the wide range of tools available to teachers and students. It is clear from the TPACK model that technology, content, and pedagogy are interrelated and that their purposeful integration is essential. According to Inan and Lowther (2010), "potential educational benefits of these investments cannot take place unless teachers are prepared to use these computers effectively in their instruction" (p. 938).

Attention, Relevance, Confidence, and Satisfaction (ARCS Model)

In this research, motivation is a factor influencing both the engagement levels and professional growth of teachers and principals. To conceptualize and evaluate motivational strategies, this study employs the ARCS Model of Motivational Design developed by John M. Keller. The ARCS framework focuses on four key components: Attention, Relevance, Confidence, and Satisfaction that contribute to enhancing educator motivation. This study aims to address the following research questions: 1) Is there a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic? 2) What is the nature of the relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic? 3) What is the nature of the relationship between time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses?

The ARCS Model provides a theoretical framework for assessing the effectiveness of professional development programs and digital platforms in capturing educators' attention, establishing relevance to their professional objectives, inspiring confidence through achievable

milestones, and ensuring satisfaction through meaningful outcomes. This approach is supported by research; for example, a study by Karimi and Hosseini Zade (2019) found that a professional development course positively influenced teachers' use of motivational strategies based on Keller's ARCS model. In the context of this study, the ARCS Model will serve both as a lens for interpreting data and as a foundation for formulating interventions.

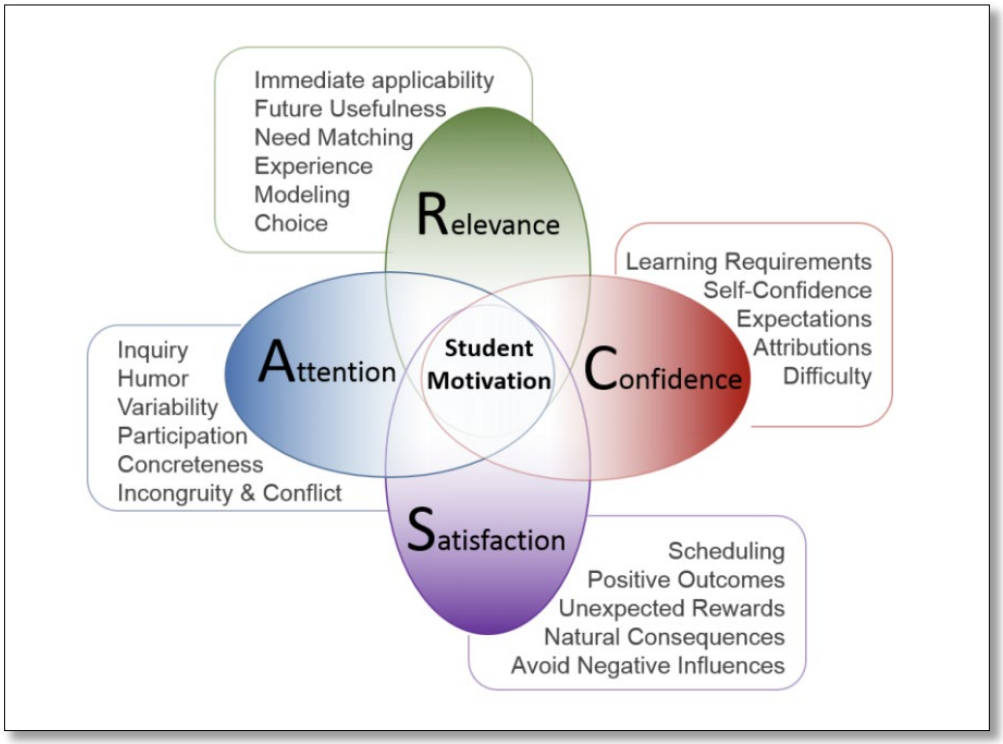

Figure 2: *Model of Motivation: ARCS Instructional Design (ARCS, 2022)*

The diagram on Figure 2 explains the components of the ARCS model. These components consist of the following:

1. **Attention** - Capturing and maintaining learners' interest is generally a foundational step for effective learning. Thus, methods to keep learners engaged should be factored in during the creation of educational materials.

2. **Relevance** - Demonstrating the relevance of the learning material helps learners understand the objective behind the educational activity.
3. **Confidence** - This domain underscores the importance of instilling in learners the belief that they have the ability to achieve success.
4. **Satisfaction** - If the instructor incorporates the other three domains—attention, relevance, and confidence into their lesson planning, learners are likely to experience satisfaction.

Motivation, Tech Integration, and the ARCS Model

In educational development, the concept of motivation serves as a cornerstone for educators and students. Motivation is defined as an "impulse or a series of impulses that drive people to actions consciously and intentionally" (Ucar & Kumtepe, 2020). This understanding of motivation will be employed to examine the effectiveness of professional development programs, specifically focusing on how they can motivate teachers to integrate digital tools like Nearpod into their teaching practices. Further extending this focus, the ARCS Model will be utilized to interpret how principal involvement in technology-related professional development could influence teachers' adoption rates of digital platforms. Each component of the ARCS Model will be explored in relation to how well they are addressed in existing professional development initiatives. Building on the premise that motivation and professional development are key to technology adoption, the role of leadership becomes equally vital in leading the educational environment toward technology integration.

The Role of a Technology-Savvy Leader in Education

Research conducted by Raman et al. (2019) indicates that over the past three decades, knowledge and skills related to technology have become critically important for effective school leadership. The involvement of administrators and technology leaders in the planning and

support process is essential to ensure that educational technology tools are effectively provided to teachers. According to Cullen and Greene (2011), technology integration is technology in a teacher's regular teaching and curricular plans. Shifflet and Weilbacher (2014) state that evidence demonstrates that beliefs can and do influence the teacher's choices regarding integrating technology for instructional purposes. Can a school district be deemed technologically advanced without a technology leader within the organization? The district should consider attracting and supporting leaders whose vision aligns with future needs. Technology-related professional development should be foundational to learning digital technology for a successful digital leader. Darling-Hammond et al. (2017) state, "As demands for deeper and more complex student learning have intensified, practitioners, researchers, and policymakers have begun to think more systematically about how to improve teachers' learning from recruitment, preparation, and support to mentoring and other leadership opportunities" (p.1).

A functional understanding of technology has become a social obligation in modern times. Zhang et al.'s (2020) study suggest that technological advancements have changed how public education communicates, interacts, and delivers instruction. The onset of COVID-19 led to technology reshaping how children learn and how teachers instruct. An effective leader must have a vision for digital literacy and become the district's digital leader to achieve the district's goals and objectives on campus. Technology affects leadership and faculty learning technology interpretation, altering the type and degree of adoption used during instruction (Adam-Turner & Burnett, 2018).

Integrating technology into every aspect of the educational process is a means for campus administrators to create a vision of 21st-century skills at the campus level. Principals who create a school vision for effective technology integration and provide continuous professional

development have been most influential in influencing teachers seeking to integrate technology in the classroom (Thannimalai & Raman, 2018). A leader should have a vision for digital literacy and become a digital leader in delivering the district's or campus' expectations and outcomes. Technology affects leadership and faculty learning technology (LT) interpretation, altering the type and degree of adoption used during instruction (Adam-Turner & Burnett, 2018).

Adam-Turner and Burnett (2018) acknowledge that leaders need digitally literate personnel to manage constant, rapid technological changes designed to support administration and teaching. Therefore, the primary role of a digital leader should be to motivate and coach the organization during the digital transformation process. To succeed in the digital era, the leader must understand how to lead teams, keep the campus engaged, develop a culture of continuous professional growth, and foster innovation. Klein (2020) emphasizes that motivation is crucial in managing digital transformation successfully.

The Integration of Technology in Education

Teachers' worldviews are the key to understanding what it means to be or not to be a teacher in a digital society (Tsybulsky & Muchnik-Rozanov, 2021). The article "Describing teacher conceptions of Technology in authentic science inquiry using technological pedagogical content knowledge as a lens" by Mishra et al. (2019) describes professional development workshops' role in enhancing teachers' technological, pedagogical, and content knowledge through the Technological Pedagogical Content Knowledge (TPACK) framework.

The article explores the significant impact of technology on student learning in science classrooms over the past decade. Mishra et al. (2019) emphasize the importance of teachers possessing sufficient knowledge of technology and its effective implementation. The study employs the TPACK framework to examine the relationship between technology and science

practice over five years. The study involved the faculty at Midwestern University in developing units for their classrooms. Over five summers, thirty-two teachers and nine master teachers participated in workshops, with each participant attending the program for one to two weeks.

The professional development model was improved based on teacher interviews, observations, document analysis, and reflections. Following each summer session, group interviews were conducted separately with participating teachers and master teachers. The interviews were conducted over a few months, and then the researchers transcribed the discussions verbatim using open coding techniques. To conclude, the study emphasizes that professional development workshops can assist in integrating technology into the classroom.

Technology use in the classroom can significantly influence educators' decisions regarding academic content, teaching objectives, pedagogical practices, and how they assess their students' learning after completing a particular lesson or lesson unit. Technology has become increasingly important in the lives of today's students, and the benefits of integrating it into the classroom are too great for teachers to ignore the necessity of incorporating technology into their curriculum. It cannot be denied that students have grown up with a culture of technology that is increasingly present in their lives. As Kao (2017) suggested, various learning activities can be created using appropriate technology.

Summary

In summary, the COVID-19 pandemic significantly accelerated the role of technology in education, laying the groundwork for lasting changes that will impact future generations. With digital tools becoming integral to the educational landscape, the need for technology-related professional development has grown increasingly important. Educators can engage in

asynchronous or synchronous professional development from anywhere, leveraging these opportunities to enhance their teaching practices. This study employed two theoretical frameworks: the ARCS Model, which will assess the motivational components of professional development, and the TPACK Model, which will explore the integration of technology, pedagogy, and content. These models will provide a comprehensive understanding of what constitutes effective teaching in today's digital age.

CHAPTER III

METHODOLOGY

Research Design

As technology permeates education, accelerated by the global COVID-19 pandemic, the role of digital platforms and professional development cannot be underestimated. This study examines this intersection, focusing on middle schools in the Lower South Texas School District during remote learning induced by the pandemic. Specifically, this research is guided by three main research questions, each probing into different aspects of technology adoption and professional development. First, is there a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic? Understanding which digital platforms were most widely used in remote learning environments. Second, what is the nature of the relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic? This can help identify whether professional development attendance impacts integrating specific digital tools like Nearpod. Finally, what is the nature of the relationship between time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses? This can provide insights into the role of leadership professional development in promoting the adoption of digital platforms at their respective campuses.

The research design for this study involved a quantitative approach. This approach was chosen to capture both numerical data related to digital platform usage and the perspectives of teachers and administrators. Data were collected on middle school core subject teachers within the Lower South Texas School District. The data were related to the integration of Nearpod lessons in their classrooms and the digital platforms they frequently used during the pandemic. Additionally, data were collected regarding the number of hours campus principals invested in technology-related professional development. The quantitative data were analyzed using statistical techniques through the Statistical Package for the Social Sciences (SPSS) program to examine correlations and associations between variables.

Furthermore, the study involved collecting in-depth insights from teachers on their experiences with integrating technology in their remote classrooms. This was achieved through open-ended questions included in the Qualtrics survey. Demographic information, educational background, and teachers' experiences in the online professional development environment were also collected to explore potential relationships.

In this study, data were collected from dependent and independent variables. The study focused on investigating three key relationships. First, it analyzed if there is a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic. Here, the frequency of use of digital platforms was the (dependent variable), and middle schools in the Lower South Texas School District (independent variable). Secondly, the relationship between teachers' professional development attendance (independent variable), and the integration of Nearpod lessons (dependent variable), during the pandemic was explored. Lastly, the study investigated the relationship between the time invested by campus principals in technology-related professional

development (independent variable), and the teachers' adoption of digital platforms (the dependent variable), during the pandemic at the principals' campuses.

Site and Participant Selection

The study focuses on core subject teachers and principals from ten middle schools in the Lower South Texas School District, a region distinguished by its blend of American and Mexican cultures. From the district's total employee pool of 6,400 during the 2019-2020 academic year, 252 middle school core subject teachers and ten middle school principals were selected as participants. A subtropical climate ensures warm weather year-round in the area. The city is home to a university campus providing various higher education options. In addition, the community is largely bilingual, with Spanish and English being widely spoken.

This study aimed to furnish educators, administrators, and stakeholders with invaluable insights into the role of technology and professional development in middle schools. In order to ensure precision and clarity in the research design, teachers were categorized by grade levels, ranging from 6th to 8th grade. This categorization provided additional contextual insight and allowed for capturing differences that might emerge in various academic settings, thereby enhancing the accuracy of the research results. Despite potential demographic variations among the selected 252 core subject teachers and ten principals, a comprehensive approach was taken in analyzing the collective data. In addition, the study outlined potential analytical techniques and models, established eligibility criteria, and examined the reliability and validity of data collection instruments.

Selection Criteria and Sampling Procedures

The study utilized a purposeful sampling process to select core subject teachers based on specific criteria: (1) Participants were employed as teachers in the Lower South Texas School District during the 2019-2020 academic year. (2) They were certified by the Texas State Board for Educators. (3) They taught middle school students in grades 6, 7, or 8 during the 2019-2020 academic year. (4) They participated in technology-related professional development between 2019 and 2021. (5) They employed technology hardware and software for remote instruction, using either asynchronous or synchronous methods.

While purposive sampling may introduce bias and limit generalization, the results of this study are expected to offer valuable insights for teachers, administrators, and stakeholders within the Lower South Texas School District. These findings could enhance future technology-related professional development, emphasizing the use of technology in teaching, learning, and the integration of online education.

Gaining Access to Participants

For this study, the researcher sought approval from the school district's Assessment, Research, and Evaluation Department to collect data. To obtain this information, the researcher reached out to the following directors in the Lower South Texas School District: The Director for Professional Development (PD), the Director of Public Education Information Management System (PEIMS), and the Director for Assessment, Research, and Evaluation (ARE). The Assessment, Research, and Evaluation Department mandated completing several forms before securing approval from the University's Institutional Review Board (IRB).

The researcher completed the following forms as required by the school district's Assessment, Research, and Evaluation Department: (1) Executive Summary (Form A) This provided a detailed overview of guidelines, including the study's aim and methodology. It also identified any potential impacts on participants. (2) Research Proposal Application (Form B) This outlined specific aspects, such as the summary of the research design and statistical analysis procedures. (3) Assurances (Form C) were binding commitments, emphasizing ethical considerations like privacy and rights of the individual and school. (4) Access to Confidential Data (Form D) granted access to confidential data within the school district for the study. (5) Principal Consent (Form F) secured support of the middle school campus principals. (6) External Research Time Requirement (Form G) detailed an estimated breakdown of the participant category, number of participants, activity and total time required for each participant dedicated to the research.

The study proceeded only after completing all these forms and securing district-level approval. This approval enabled the researcher to access various data platforms, such as the Professional Development Learning System, which revealed the number of trainings for each workshop and the hours for both teachers and principals. Additionally, data from Clever provided insight into each software application, detailing its classroom usage and the total number of applications used by the district and individual schools.

Upon receiving approval from the Institutional Review Board (IRB), the researcher initiated the survey data collection process using the Qualtrics platform. Participants were emailed describing the study's procedures, ensuring participant confidentiality and school anonymity.

Instruments

The main objective of this study is to investigate the usage of digital educational platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic and assess the impact of professional development on the integration and adoption of these platforms. To gain firsthand insights into educators' experiences, a questionnaire titled "Learning Online: Technology Related Professional Development" was disseminated via email to the participating teachers.

The questionnaire was designed using the University of Texas Rio Grande Valley (UTRGV) Qualtrics online survey tool. It comprised thirty-six questions, organized into five sections as outlined in Appendix A. Each section utilized diverse response scales to ensure feedback and depth of understanding. Specifically, these questions included Likert scales, multiple choice options, open-ended, and matrix questions.

The first section, comprising seven questions, utilized the ARCS model to gather insights into teachers' attitudes and opinions towards professional development, offering an understanding of how educators perceive learning opportunities. The second section, also guided by the ARCS model, consisted of twelve questions focusing on the challenges and prospects of remote instruction amidst the rising use of online learning platforms. The third section pivoted towards the TPACK model, containing five questions aimed at gauging teachers' comfort and familiarity with integrating technological, pedagogical, and content knowledge into their teaching methods. The fourth section posed four questions centered on the influence of campus leadership in digital implementation from the teachers' perspective. The fifth and final section consisted of eight questions gathering demographic information, thus providing contextual

background and experiences of the participating teachers. This questionnaire sought to provide insights into how technology-related professional development affects the teaching methods and outcomes of middle school core subject teachers in the Lower South Texas School District.

For reliability analysis, specific sections of the data collected yielded the following Cronbach's Alpha values: The Comprehensive Teacher Profile and Technology Integration section had a Cronbach's Alpha of $\alpha = .680$, with 12 items and a sample size of 252, placing it in the questionable range. The data on Teachers' Adaptation to Technology and Professional Development in the Wake of COVID-19"reported a Cronbach's Alpha of $\alpha = .878$, based on 61 items with a sample size of 10, deeming it as good. Lastly, the Comprehensive Principal and Campus Technology Utilization Profile data demonstrated a Cronbach's Alpha of $\alpha = .794$, consisting of 19 items and 57 participants, categorizing it as acceptable.

Data Collection Procedures

After securing approval from the Institutional Review Board at the University of Texas Rio Grande Valley and the school district’s departments in the Lower South Texas School District, including the Assessment, Research and Evaluation Department, Professional Development Department, and Public Education Informative Management Systems Department a mixed research method was used.

The data collection strategy for this study was the administration of an online questionnaire named "Learning Online: Technology-Related Professional Development." The link to this questionnaire was initially sent to campus principals, who then forwarded it to their respective core subject middle school teachers within the Lower South Texas School District.

These teachers were all teaching during the 2019-2020 academic year. It was organized into five sections: Opinions and Attitudes of Professional Development, Using Technology to Deliver Instruction Remotely to Students, TPACK Model Integration, The Importance of a Digital Leader, and Teacher Demographics. Participants were estimated to take approximately 25 minutes to complete the questionnaire. Consent was secured via an online link, making the survey available for teachers to review. This procedure offered insights into middle school teachers' attitudes, experiences, and tech-related professional development needs. The online questionnaire can be found in Appendix A.

The subsequent data collection phase utilized the Lower South Texas School District's professional learning database. This tool provided details on the count of teachers and school leaders who attended technology-related workshops from March 2019 to February 2020, revealing the number of courses they participated in, and the total hours dedicated to technological topics. This data was stored electronically on Google Drive and the Brownsville Independent School Professional Development Learning System.

Lastly, the Clever analytical dashboard was employed to identify the most frequently used digital applications during the 2019-2020 academic year and assess their usage patterns. This tool enabled the researcher to collate data on various digital instruments and software applications utilized by middle school core subject educators and principals in the Lower South Texas School District. The information obtained from the dashboard was essential to the study as it provided insights into the digital tools and software applications that middle school teachers and principals frequently used for instructional purposes.

In summary, the data collection procedures for this study involved using a Qualtrics questionnaire, the district's professional learning database, and Clever's analytical dashboard.

The Qualtrics questionnaire was administered through an online survey and was sent to middle school core subject employees at Lower South Texas School District. The district's professional learning database determined the number of teachers and principals who attended technology-related workshops, the number of courses they attended, and the number of hours they spent learning technology-related topics. Clever's analytical dashboard was also used to determine the most frequently used digital applications during the 2019-2020 school year.

Data Analysis Procedures

The data analysis procedures for this study involved conducting exploratory data analysis using the Statistical Package for the Social Sciences (SPSS) software to analyze the collected data. Specifically, the researcher focused on several key relationships. First, the researcher examined the frequency of use of digital platforms as the (dependent variable), with middle schools in the Lower South Texas School District as the (independent variable). Secondly, the researcher explored the relationship between teachers' professional development attendance as the (independent variable) and the integration of Nearpod lessons as the (dependent variable) during the pandemic. Lastly, the study investigated the relationship between the time invested by the campus principal in technology-related professional development as the (independent variable) and the teachers' adoption of digital platforms as the (dependent variable) during the pandemic at the principal's campus. Correlation analysis techniques were employed to investigate these research questions.

Limitations

The researcher acknowledged several limitations that could have compromised the study's internal and external validity. Therefore, one needs to exercise caution while generalizing based on the research findings. These limitations were as follows: (a) The study was limited to educators who worked in ten middle schools in the Lower South Texas School District. (b) The study's duration was limited to the COVID-19 pandemic era, which could limit the generalizability of the results to other contexts or periods. (c) Response bias might have influenced the study's findings, as participants may have provided inaccurate or dishonest responses to the survey questions. (d) The survey instrument was emailed to participants, and the responses were collected electronically via Qualtrics. (e) The study cannot determine causality, as other factors could have contributed to the relationship between a principal's personal technology-related professional development and the utilization of digital platforms on their campus (f) The potential variations in individual teachers' access to and comfort with technology could influence their participation and the results. (g) The study did not differentiate findings based on subjects that may vary in their suitability for online instruction. (h) The lack of consideration for students' home environments, which could significantly impact the effectiveness of remote learning, makes it challenging to determine if low effectiveness is due to teaching methods, tech platforms, or students' home environments. (i) not accounting for external teaching resources or communities such as out-of-district or online training from outside sources.

In this research, various limitations were identified that may have affected the findings' internal and external validity. While the study provided valuable insights into teachers' experiences within ten middle schools in the Lower South Texas School District over the COVID-19 pandemic era, it is essential to approach the results with a discerning eye. Factors

such as potential response biases, the sole use of electronic means for data collection, and challenges in establishing causality underscore the complexities of this investigation. Moreover, nuances such as variations in teachers' technological proficiency, the differential applicability of online instruction across subjects, and external teaching influences further highlight the intricacies of the research context. While these constraints shape the interpretation of the findings, they also pave the way for future research to dive deeper into these aspects, ensuring a holistic understanding of the dynamics of digital education during challenging times.

Delimitations

Due to the COVID-19 pandemic, teachers were mandated to utilize innovative technologies in the classroom to educate their students. This shift resulted in remote learning playing an increasingly significant role at the district and campus levels. Despite the demand for the use of modern technology in education, there was still a lack of understanding of its value. Additionally, educators recognized a lack of learning communities to facilitate and support their development of digital literacy.

While conducting the research, the following delimitations were identified: (1) the study was limited to middle schools in Lower South Texas School District, which could restrict the generalizability of the findings to other school districts or regions. (2) the study only focused on the relationship between professional development attendance and the implementation of Nearpod lessons, and other factors that could affect the use of digital platforms in the classroom were not considered. (3) the study only included data collected during the COVID-19 pandemic, and the results may not apply to other educational contexts or time periods. (4) self-reported data from teachers and principals were used, which could be subject to bias or errors in recall. (5) the

study did not account for other contextual factors that could impact the implementation of digital platforms, such as differences in resources, school culture, or student population. (6) teachers and principals could select which technology-related professional development opportunities best aligned with their learning goals. (7) Not all teachers may have had equal access to technology tools, or they may vary in their technological skills, influencing their utilization of online tools or platforms. (8) The study did not differentiate based on subjects that might have varied suitability for online tools. (9) While the study evaluated the teachers' use of technology, it did not consider the home environment of students, which could impact the success of remote learning. (10) The study did not account for external teaching communities or resources that teachers might have had access to, influencing their teaching methods.

Furthermore, it must be acknowledged that the implementation of technology integration in classrooms was likely affected by the unique challenges posed by the COVID-19 pandemic. Beyond impacting educators' emotional state and well-being, the pandemic brought about a series of additional complications. Teachers had to adapt to unfamiliar teaching methods, which posed challenges. Both students and teachers experienced engagement issues due to screen fatigue. The validity of student assessments was questioned because it was difficult to identify cheating. Additionally, face-to-face communication and emotional learning suffered. Lastly educators and students struggled with managing time in this landscape. These challenges highlight some of the situations that educators faced during this time.

CHAPTER IV

FINDINGS

Site and Participants

This study investigated the adoption and utilization of digital educational platforms and the impact of professional development in middle schools in the Lower South Texas School District during the COVID-19 pandemic. Specifically, it sought answers to the following questions:

1. Is there a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic?
2. What is the nature of the relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic?
3. What is the nature of the relationship between time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses?

A null hypothesis and a research hypothesis were developed to test the hypotheses developed for this study. The null hypotheses states there is no significant difference in the usage frequency of digital educational platforms among middle schools in Lower South Texas School District during the COVID-19 pandemic; there is no significant relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic; and there is no significant relationship between the time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses.

However, the study proposed three research hypotheses concerning the COVID-19 pandemic. The first hypothesis suggests that there is a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic.; a significant relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic. Finally, the third hypothesis there is a significant relationship between the time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses.

Teacher Characteristics

Age & Teaching Experience of Lower South Texas Middle School Teachers: 2019-2020

This study examined the age and experience (in years) of middle school core subject teachers in Lower South Texas School District during the 2019-2020 academic school year. Descriptive statistics were calculated for both variables based on data collected from 252 participants. The age range was 40 years, with the youngest participant being 26 years old and the oldest being 66 years old. The mean age of the participants was 47.45 years (M = 47.45, SD = 8.62). In terms of experience, the range was 38 years, with participants having between 1 and 39 years of experience. On average, the participants had a mean of 16.49 years of experience (M = 16.49, SD = 7.77).

Table 1

Age and Teaching Experience of Middle School Core Teachers

	n	Range	Min	Max	*M*	*SD*
Age	252	40	26	66	47.45	8.62
Experience (Years)	252	38	1	39	16.49	7.77

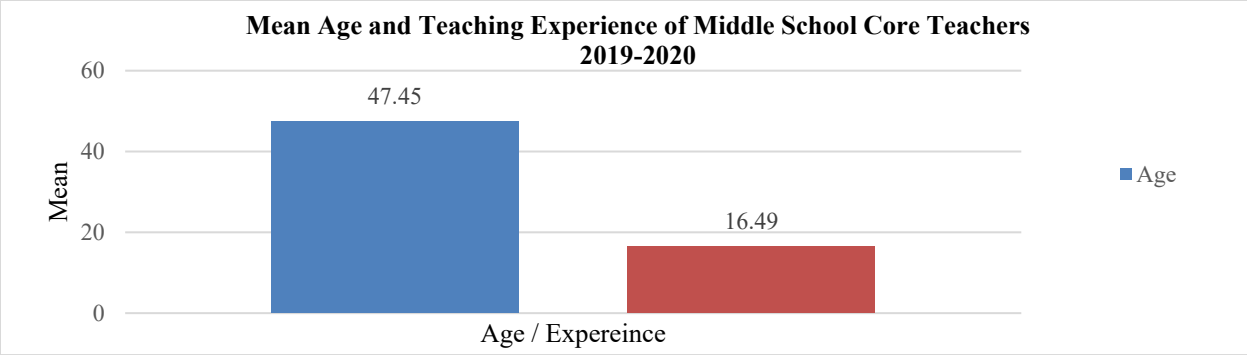

Figure 3: *Age and Teaching Experience of Middle School Core Teachers, 2019-2020*

Teacher Gender Descriptives for the 2019-2020 Academic School Year

The descriptive statistics concentrated its focus on assessing differences between teachers' gender. Within this sample of teachers, 252 participated in the study, 66.7% (168) were female, while 33.3% (84) were male, indicating a dominant presence of female teachers. Within the sample, there were 84 male teachers, whose ages ranged from 29 to 66 years, with a mean age of 47.33 years ($M = 47.33$, $SD = 7.92$). In addition, the sample included 168 female teachers, with ages ranging from 26 to 66 years, and a mean age of 47.51 years ($M = 47.51$, $SD = 8.98$).

Table 2

Teacher Gender Distribution of Middle School Core Teachers

	Frequency	Percent	Cumulative Percent
Females	168	66.7	66.7
Males	84	33.3	100
Total	252	100	

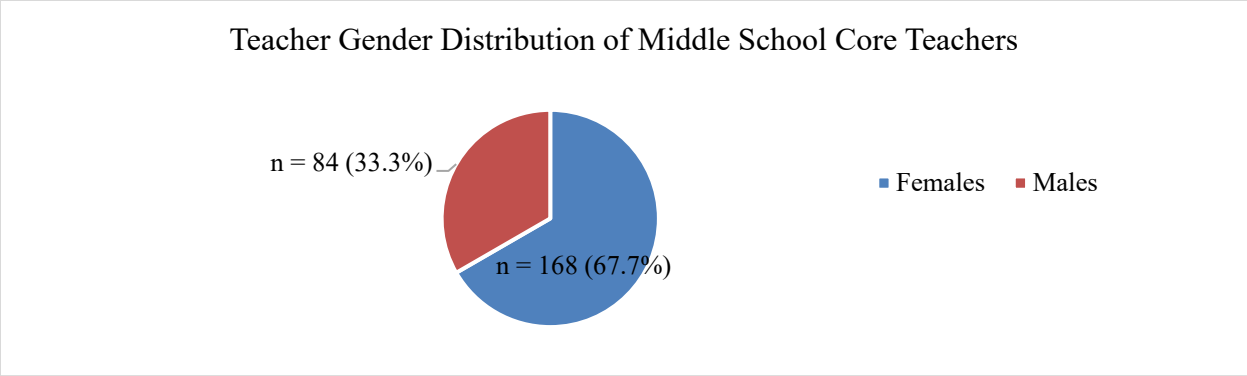

Figure 4: *Teacher Gender Distribution of Middle School Core Teachers*

Table 3

Teacher Gender and Age Distribution of Middle School Core Teachers

	n	Min	Max	*M*	*SD*
Males	84	29	66	47.33	7.92
Females	168	26	66	47.51	8.98

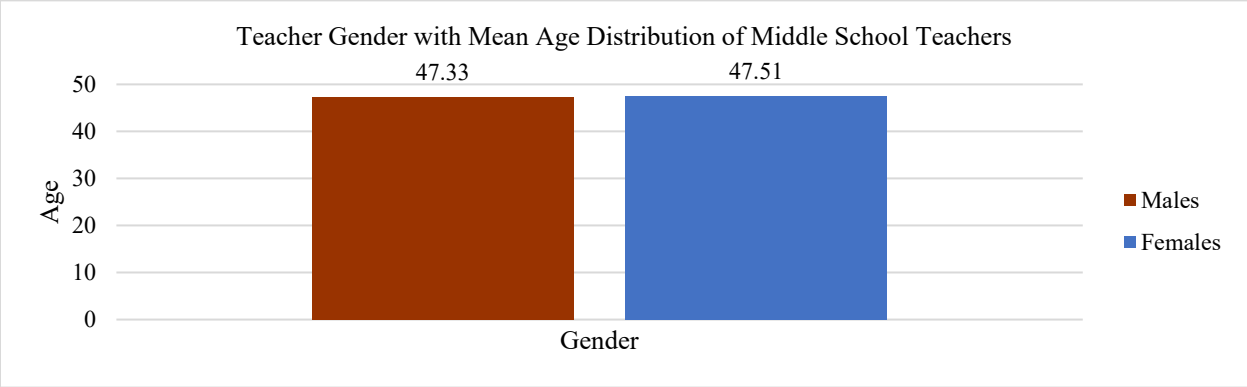

Figure 5: *Teacher Gender with Mean Age Distribution of Middle School*

Subject Distribution Among Middle School Teachers: 2019-2020 Academic Year

The study's findings in middle school teaching during the academic year of 2019-2020 revealed that teachers covered eight distinct subjects for their students. Of these areas of study, English was the subject with the highest number of teachers, taught by 57 teachers (22.6%). Reading proved similarly synonymous with the second most taught subject, with 51 teachers

(20.2%). Math was taught by 43 teachers (17.1%), while science was taught by 42 teachers (16.7%). Social Studies was taught by 14 teachers (5.6%), while Texas History and US history were taught by 16 (6.3%) and 17 (6.7%) teachers, respectively. Algebra had the fewest number of teachers, with only 12 teachers (4.8%) in the district.

Table 4

Subjects Taught by Middle School Core Teachers

	n	Percent	Cumulative Percent
Algebra	12	4.8	4.8
English	57	22.6	27.4
Math	43	17.1	44.4
Reading	51	20.2	64.7
Science	42	16.7	81.3
Social Studies	14	5.6	86.9
Texas History	16	6.3	93.3
US History	17	6.7	100
Total	252	100.0	

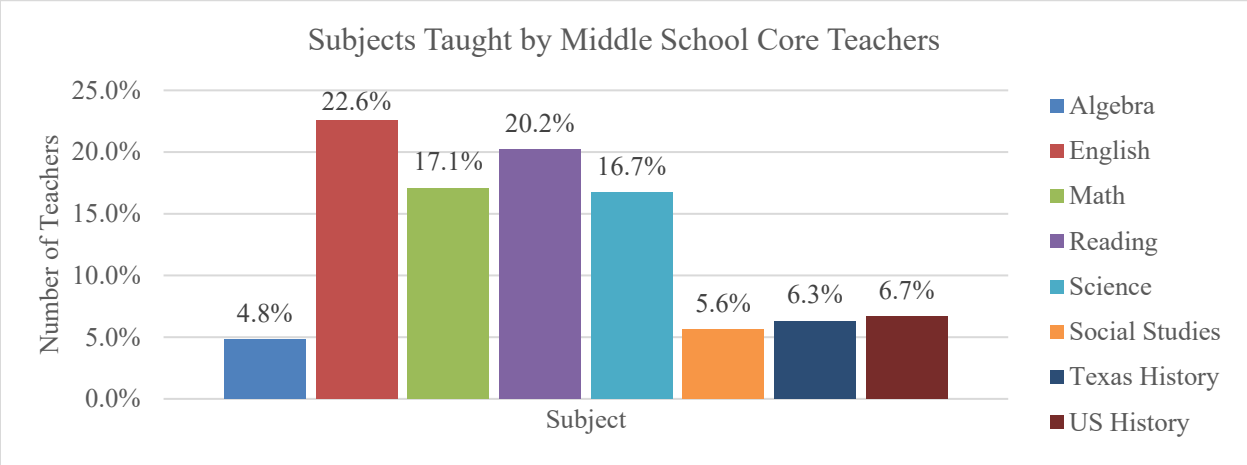

Figure 6: *Subjects Taught by Middle School Core Teachers*

Gender and Subject Distribution Among Middle School Teachers: Detailed Analysis

The study observed a total of 252 educators, out of which most of them were female, 168 (66.7%), and 84 (33.3%) were male. English was the subject taught most frequently by a notable

amount with the highest frequency taught by female teachers, 49 (29.2%). Another commonly taught subject for females was Reading with 44 (26.2%). Science had the third-highest frequency with 25(14.9%) female teachers, followed by Math with 21(12.5%). Algebra saw a representation of 8 (4.8%) female teachers. Texas History and US History also had 8 (4.8%) female educators each. Social Studies had the lowest representation with only 5 (3.0%) female teachers.

In regard to our male teachers, Math had the highest frequency of 22 (26.2%) teachers who taught that subject. The subject to follow was Science with 17 (20.2%), Social Studies and US History were each taught by 9 (10.7%) teachers, while Texas History and English were each taught by 8 (9.5%) teachers. Reading had the lowest frequency, with only 7 (8.3%) teachers. Altogether, Algebra had the lowest frequency with only 4 teachers (4.8%).

Algebra saw a representation of 8 (4.8%) female teachers. Texas History and US History also had 8 (4.8%) female educators each. Social Studies had the lowest representation with only 5 teachers (3.0%). The sample of 252 teachers comprised 168 (66.7%) female and 84 (33.3%) male participants, of which 72 (42.9%) were teaching grades 6 and 7 and 55 (32.7%) in grade 8. Of female participants, 72 (42.9%) taught grade 6, while 42% (42.4%) of those teaching grades 7/8 were female teachers. As for the male participants, 32 (38.1%) of them concentrated their efforts at grade level 6, 27 (32.1%) were involved with teaching grades 7/8, respectively, and only 25 (29%8) teachers taught this grade level 6. Descriptive statistics indicate a higher proportion of female participants than men within this sample population.

Table 5

Gender Distribution by Subjects Taught

Gender	Subject	n	Percent	Cumulative Percent
Female	Algebra	8	4.8	4.8
	English	49	29.2	33.9
	Math	21	12.5	46.4
	Reading	44	26.2	72.6
	Science	25	14.9	87.5
	Social Studies	5	3.0	90.5
	Texas History	8	4.8	95.2
	US History	8	4.8	100.0
	Total	168	100.0	
Male	Algebra	4	4.8	4.8
	English	8	9.5	14.3
	Math	22	26.2	40.5
	Reading	7	8.3	48.8
	Science	17	20.2	69.0
	Social Studies	9	10.7	79.8
	Texas History	8	9.5	89.3
	US History	9	10.7	100.0
	Total	84	100.0	

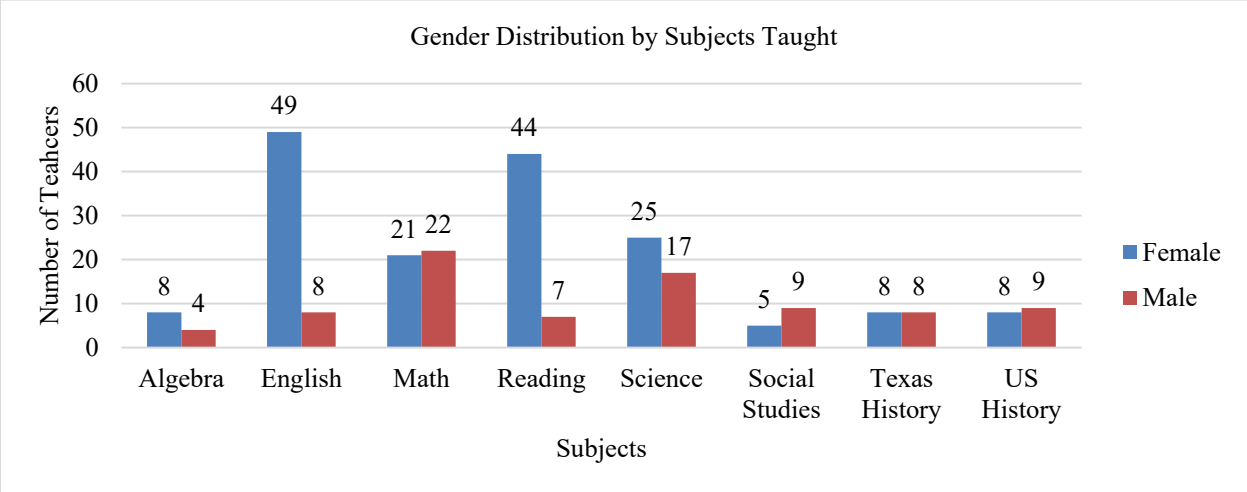

Figure 7: *Gender Distribution by Subjects Taught*

Table 6

Middle School Core Teachers by Grade Level

Grade Level	n	Percent	Cumulative Percent
6	104	41.3	41.3
7	82	32.5	73.8
8	66	26.2	100.0
Total	252	100.0	

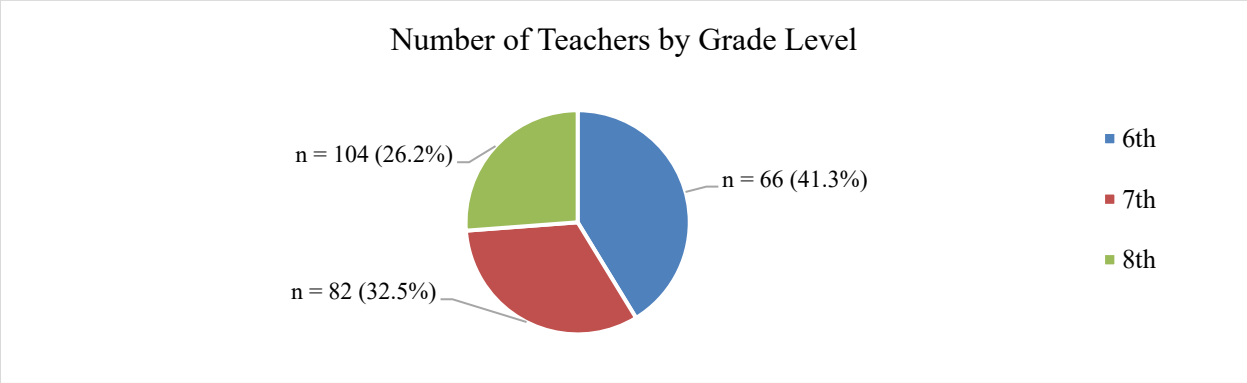

Figure 8: *Middle School Core Teacher by Grade Level*

Table 7

Mean Age of Teachers by Grade Level

Grade Level	n	Min	Max	*M*	*SD*
6	104	26	64	47.84	8.80
7	82	27	66	48.02	8.49
8	66	27	66	46.12	8.49

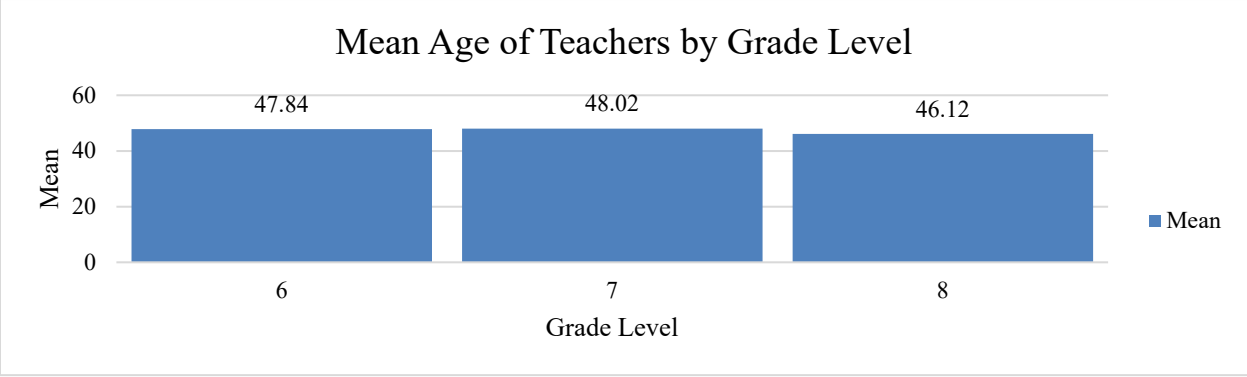

Figure 9: *Mean Age of Teachers by Grade Level*

Table 8

Gender Distribution of Middle School Core Teachers by Grade Level

Teacher Gender	Grade Level	n	Percent
Females	6	72	42.9
	7	55	32.7
	8	41	24.4
	Total	168	100.0
Males	6	32	38.1
	7	27	32.1
	8	25	29.8
	Total	84	100.0

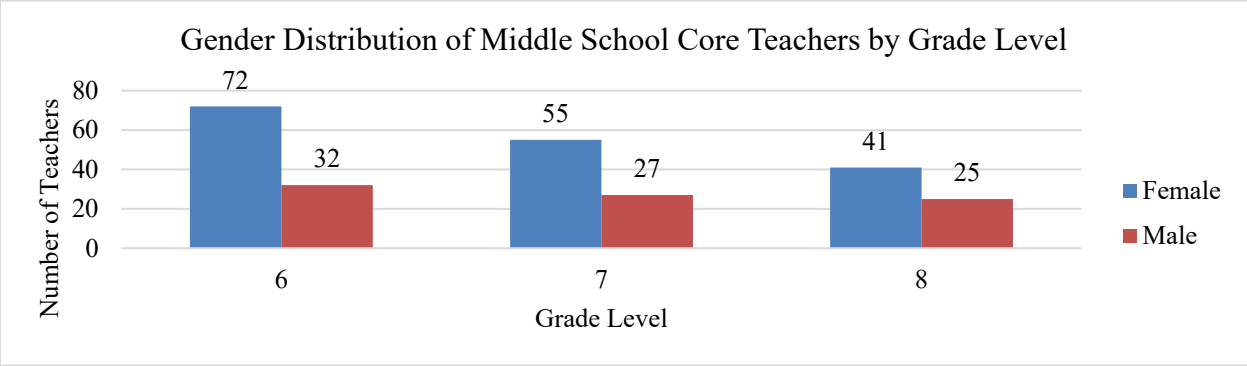

Figure 10: *Gender Distribution of Middle School Core Teachers by Grade Level*

Gender and Age Demographics Across Ten Campuses

Ten different campuses were assessed, and demographic information concerning educators was collected. The analysis revealed gender disparity among the teaching personnel, where some campuses occupied more women than men. The results revealed that Campus 01 had 18 (7.1%), teachers, with a higher percentage of females (72.2%) compared to males (27.8%). Furthermore, Campus 02 had 28 (11.1%) teachers, with females constituting a slightly higher percentage (57.1%) than males (42.9%). Campus 03 had 26 (10.3%), teachers, with the highest percentage of females (80.8%) compared to males (19.2%). Campus 04 had 22 (8.7%) teachers, females (72.7%), and males (27.3%). Campus 05 had 27 (10.7%), teachers, with (66.7%) females and 33.3% males.

Campus 06 had 27 (10.7%), teachers, with females (59.3%) constituting most participants and males (40.7%) constituting the minority. Campus 07 had 15 (6.0%), teachers, with a higher percentage of males (66.7%) than females (33.3%). Campus 08 had 27 (10.7%), teachers, with (66.7%) females and (33.3%) males. Campus 09 had the highest number of teachers, with 37 (14.7%), the highest percentage of females (75.7%), and the smallest percentage of males (24.3%). Finally, Campus 10 had 25 teachers (9.9%), with females at (68.0%) and males (32.0%) constituting the minority.

Regarding age demographics, Campus 01 had the narrowest age range (32 to 59), with a mean of 47.22 (M = 47.22, SD = 7.96). Campus 02 had a wider range of ages (26 to 62), a standard of 47.11 (M = 47.11, SD = 10.36), and a similar mean score to Campus 01. Campus 03 had a range of ages from 27 to 62, with a mean of 49.38 (M = 49.38, SD = 8.42). Campus 04 had a range of ages from 29 to 66, with a mean of 46.95 (M = 46.95, SD = 8.29). Campus 05 had a range of ages from 33 to 59, with the lowest mean score of all campuses at 44.67 (M = 44.67, SD = 7.01). Campus 06 also had a wide age range (27 to 66), with a mean of 44.89 (M = 44.89, SD = 10.18). Campus 07 had the widest age range (37 to 66), with a standard of 47.73 (SD = 8.084). Campus 08 had a range of ages from 33 to 62, with a mean of 48.78 (M = 48.78, SD = 7.213). Campus 09 ranged from 29 to 64, with a mean of 48.81 (M = 48.81, SD = 8.941), and Campus 10 had a range of ages from 31 to 63, with a mean of 48.56 (M = 48.56, SD = 8.46).

Table 9

Campus and Number of Middle School Core Subject Teachers

Campus	n	Percent	Cumulative Percent
C01	18	7.1	7.1
C02	28	11.1	18.3
C03	26	10.3	28.6
C04	22	8.7	37.3
C05	27	10.7	48.0
C06	27	10.7	58.7
C07	15	6.0	64.7
C08	27	10.7	75.4
C09	37	14.7	90.1
C10	25	9.9	100.0
Total	252	100.0	

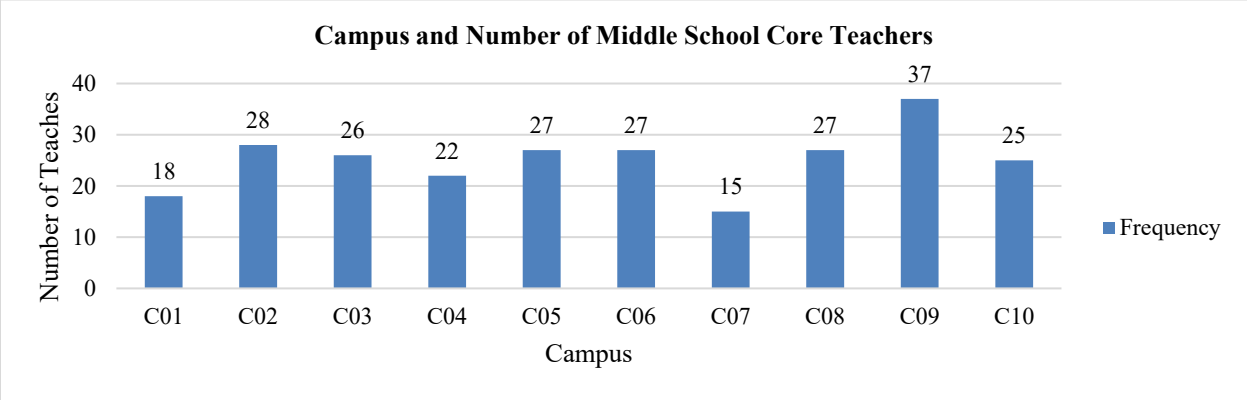

Figure 11: *Campus and Number of Middle School Core Subject Teachers*

Table 10

Campus and Mean Age of Teachers (years)

Campus	n	Min	Max	*M*	*SD*
C01	18	32	59	47.22	7.96
C02	28	26	62	47.11	10.36
C03	26	27	62	49.38	8.42
C04	22	29	66	46.95	8.29
C05	27	33	59	44.67	7.01
C06	27	27	66	44.89	10.18
C07	15	37	66	47.73	8.08
C08	27	33	62	48.78	7.21
C09	37	29	64	48.81	8.94
C10	25	31	63	48.56	8.46

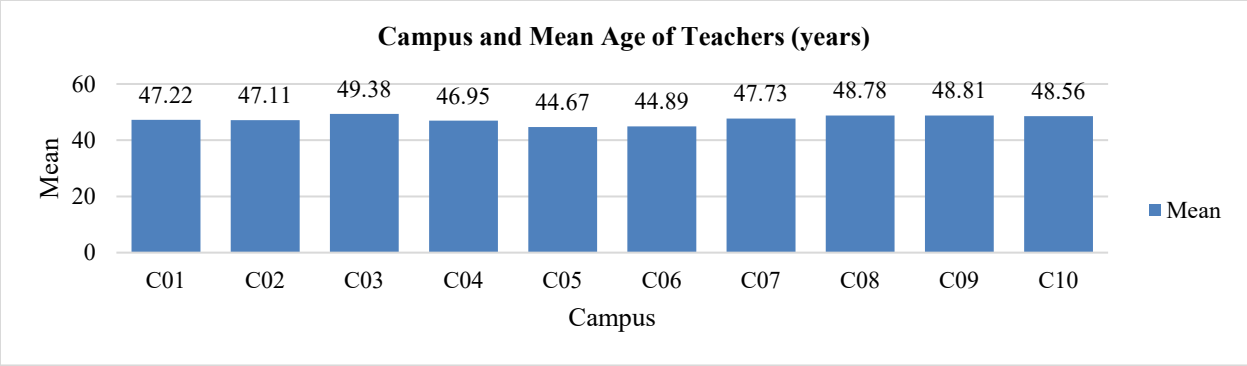

Figure 12: *Campus and Mean Age of Teachers (years)*

Table 11

Gender Distribution by Campus

Campus	Gender	n	Percent	Cumulative Percent
C01	Females	13	72.2	72.2
	Males	5	27.8	100.0
C02	Females	16	57.1	57.1
	Males	12	42.9	100.0
C03	Females	21	80.8	80.8
	Males	5	19.2	100.0
C04	Females	16	72.7	72.7
	Males	6	27.3	100.0
C05	Females	18	66.7	66.7
	Males	9	33.3	100.0
C06	Females	16	59.3	59.3
	Males	11	40.7	100.0
C07	Females	5	33.3	33.3
	Males	10	66.7	100.0
C08	Females	18	66.7	66.7
	Males	9	33.3	100.0
C09	Females	28	75.7	75.7
	Males	9	24.3	100.0
C10	Females	17	68.0	68.0
	Males	8	32.0	100.0

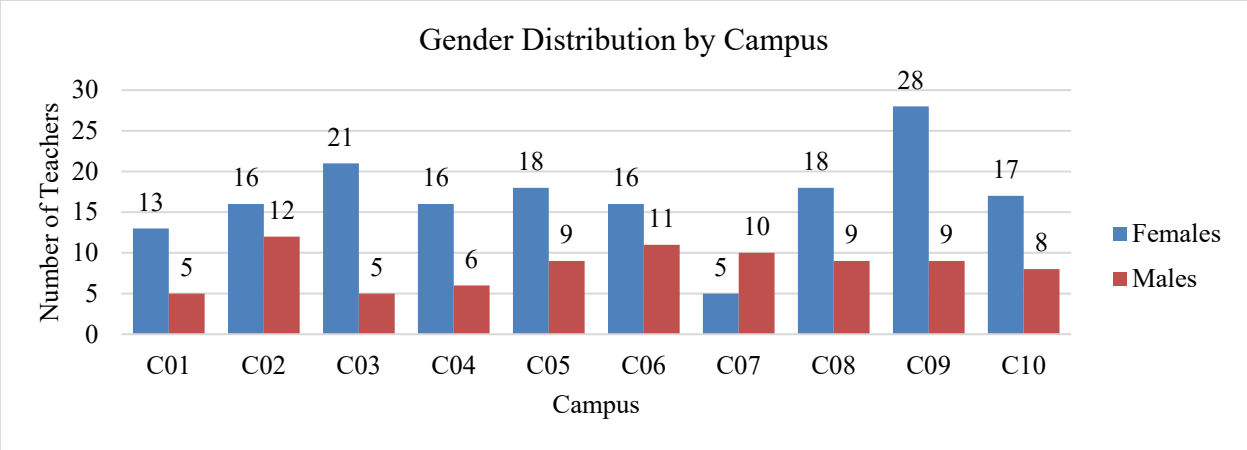

Figure 13: *Gender Distribution by Campus*

Nearpod Usage Trends Over Three Academic Years (2019-2022)

Understanding each campus' demographics is important for understanding the utilization of educational digital platforms, the number of workshops attended, and the hours teachers spend on them. By examining the demographic characteristics of each campus, the researcher identified similarities and differences in usage patterns.

The study found that Nearpod, an educational technology platform, had different usage patterns across three academic years: 2019-2020, 2020-2021, and 2021-2022. In the first academic year, Nearpod had a low usage frequency, with 247 (98%) teachers representing the total sample who did not use the program, while only 5 (2%) teachers used the program. This indicates that Nearpod was not widely used or adopted by teachers during the 2019-2020 academic school year.

Nearpod's usage frequency increased in the second academic year, with 139 (55.2%) teachers using the program, while 113 (44.8%) teachers did not use the program. This suggests that more educators became aware of Nearpod and started using it in the classroom to support teaching and learning activities.

However, in the third academic year, Nearpod's usage frequency remained low at 90 (35.7%) teachers used the program while 162 (64.33%) did not; this indicates that Nearpod did not sustain its adoption and usage from year two to three. These results demonstrate that, while Nearpod was not widely utilized during its first year, its usage increased during its second year while remaining low during its third. More research may be necessary to uncover factors contributing to its initial low adoption and subsequent increase in usage during its second year and what factors led to its reduction during its third year of usage.

Table 12

Nearpod Usage Trends Among Teachers Across Three Academic Years

Academic Year	Not Used	Percentage of Non-Usage	Used	Percentage Used
2019-2020	247	98	5	2
2020-2021	113	44.8	139	55.2
2021-2022	162	64.3	90	35.7

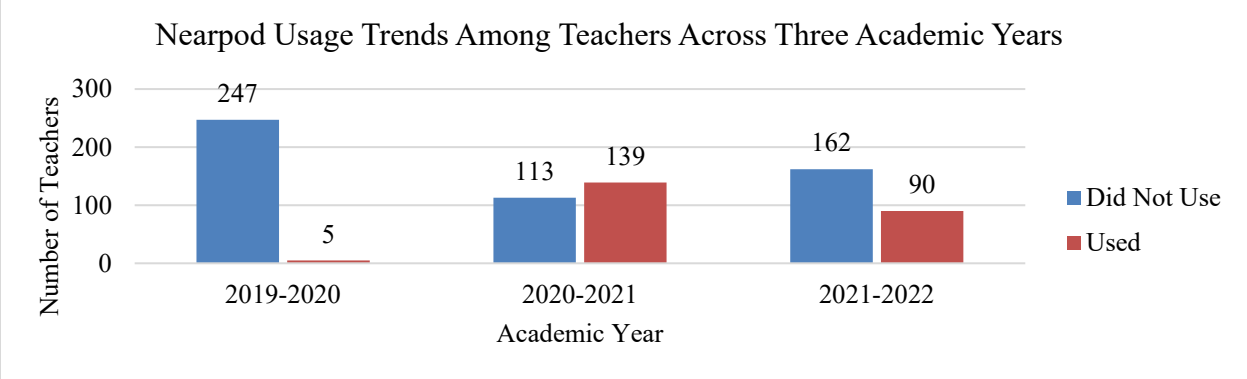

Figure 14: *Nearpod Usage Trends Among Teachers Across Three Academic Years*

Teacher Age, Workshop Attendance, and Technology Training: Correlation Insights

The Pearson correlation analysis revealed a weak, but statistically significant, positive correlation between teacher age and the total number of technology workshops attended, $r(250) = .138$, $p = .028$. This suggests that an increase in teacher age was associated with a slight

increase in attendance at technology-related workshops. However, no significant correlations were found between teacher age and the total technology hours or total number of teacher certifications

Furthermore, a strong positive correlation was observed between the total number of technology-related workshops attended and the total number of technology hours spent in training, $r(250) = .851$, $p < .001$. This indicates that as the number of technology workshops attended increased, the total technology hours spent on training also increased significantly. No significant correlations were found between the other variables. These findings suggest that as attendance at technology-related workshops increases, there is a corresponding increase in technology-related training hours.

Table 13

Correlations: Teacher Age, Technology Workshops, Hours, and Certifications

		1	2	3	4
1. Teacher Age	Pearson Correlation	-			
	Sig. (2-tailed)				
	N	252			
2.Technology Related Workshops	Pearson Correlation	.138*	-		
	Sig. (2-tailed)	0.028			
	N	252	252		
3. Technology Related Hours	Pearson Correlation	0.091	.851**	-	
	Sig. (2-tailed)	0.151	0.000		
	N	252	252	252	
4. Total # of Teacher Certification	Pearson Correlation	0.117	0.027	0.000	-
	Sig. (2-tailed)	0.063	0.675	0.995	
	N	252	252	252	252

Gender Differences in Teaching Experience, Certifications, and Technology Usage

Table 14 displays descriptive statistics related to teacher gender, age, teaching experience, number of certifications earned, and technology-related variables in their sample of 84 male and 168 female teachers. Male teachers averaged 47.33 years old ($M = 47.33$, $SD =$

7.92), while female teachers averaged 47.51 (*M* = 47.51, *SD* = 8.98). Male teachers mean teaching experience totaled 16.13 (*M* = 16.13, *SD* = 7.47), with female teachers contributing 16.67 years of service for themselves (*M* = 16.67, *SD* = 7.93).

The male teachers averaged 2.21 certifications (*M* = 2.21, *SD* = 1.16), while female teachers held 2.54 certifications on average (*M* = 2.54, *SD* = 1.16). Concerning technology-related variables, male teachers attended an average of 30.9 (*M* = 30.90, *SD* = 17.17) technology-related workshops and spent an average of 57.58 (*M* = 57.58, *SD* = 33.21) hours engaged in technology workshops. Female teachers reported attending 39.41 (*M* = 39.41, *SD* = 20.02) technology-related workshops, reaching 66.38 (*M* = 66.38, *SD* = 31.86) hours engaged in technology workshops.

Table 14

Gender Comparison: Teacher Age, Experience, Certifications and Tech Training

	Gender	n	*M*	*SD*
Teacher Age	male	84	47.33	7.92
	female	168	47.51	8.98
Teaching Experience (Years)	male	84	16.13	7.47
	female	168	16.67	7.93
Total # of Teacher Certification	male	84	2.21	1.16
	female	168	2.54	1.16
Technology-Related Workshops	male	84	30.90	17.17
	female	168	39.41	20.02
Technology-Related Hours	male	84	57.58	33.21
	female	168	66.38	31.86

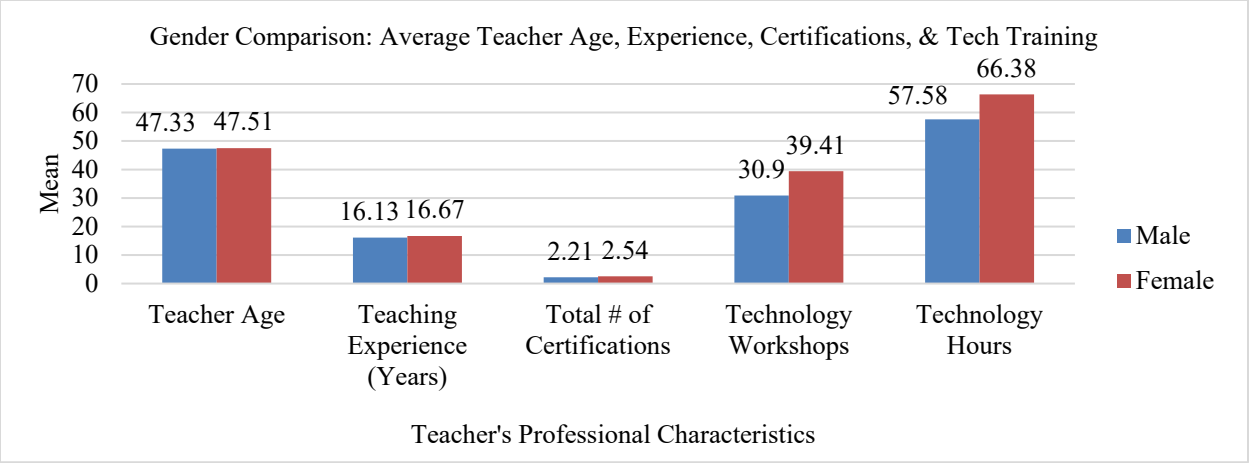

Figure 15: *Gender Comparison: Teacher Age, Experience, Certifications, & Tech Training*

Gender Differences in Nearpod Workshop Attendance and Training Hours

Moreover, significant differences were found between male and female teachers in terms of the total number of Nearpod workshops attended: male (n = 84, *M* = 1.00, *SD* = 1.07), female (n = 168, *M* = 1.58, *SD* = 1.55), indicating that female teachers attended significantly more Nearpod workshops than male teachers. Similarly, significant differences were found between male and female teachers in terms of the number of hours of Nearpod training attended: male (n = 84, *M* = 1.33, *SD* = 1.33); female (n = 168, *M* = 2.04, *SD* = 1.82), indicating that female teachers attended significantly more hours of Nearpod training than male teachers.

Table 15

Mean Gender Comparison: Total Nearpod Workshops Attended and Hours Spent

Variable	Teacher Gender	n	*M*	*SD*
Nearpod Technology-Related Workshops	male	84	1.00	1.07
	female	168	1.58	1.55
Nearpod Technology-Hours	male	84	1.33	1.33
	female	168	2.04	1.82

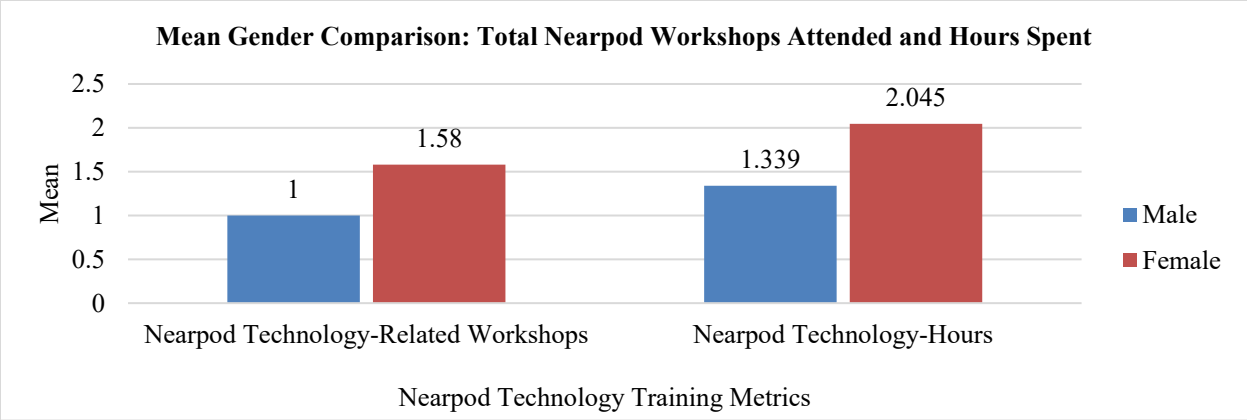

Figure 16: *Mean Gender Comparison: Total Nearpod Workshops Attended and Hours Spent*

Gender Differences in Class Sizes and Nearpod Sessions: 2019-2022 Analysis

Finally, the number of teachers, mean and standard deviation for various metrics related to total class size and Nearpod technology sessions for academic years 2019-2020, 2020-2021, and 2021-2022, categorized by gender, and the following findings were obtained.

During the 2019-2020 academic year, a comparison between female and male teachers revealed differences in total class sizes and Nearpod technology sessions. Female teachers exhibited a mean total class size of 102.08 (n = 168, M = 102.08, SD = 59.72), while their male teachers demonstrated a mean total class size of 89.73 (n = 84, M = 89.73, SD = 39.89). Regarding Nearpod sessions for the same year, female teachers averaged 0.32 sessions (M = 0.32, SD = 2.03), unlike male teachers, who averaged 0.00 Nearpod sessions.

Moving onto the academic year 2020-2021, female teachers had a mean total class size of 20.90 (n = 168, M = 20.90, SD = 28.86), whereas male teachers reported a mean of 17.58 (n = 84, M = 17.58, SD = 22.17). Moving to Nearpod sessions, both groups exhibited almost identical mean values. An exploration of Nearpod sessions during this period showed an average of 39.74

sessions for female teachers (M = 39.74, SD = 72.35,) compared to a slightly higher average of 39.79 sessions for male teachers (M = 39.79, SD = 87.35).

For the academic year 2021-2022, the data illustrated gender-based variations. Female teachers had an average total class size of 13.99 (n = 168, M = 13.99, SD = 26.61), while male teachers had a slightly higher average class size of 16.35 (n = 84, M = 16.35, SD = 33.51). Regarding Nearpod sessions for this academic year, female teachers reported a mean of 13.96 sessions (M = 13.96, SD = 36.61), with male teachers exhibiting a mean of 13.27 sessions (M = 13.27, SD = 33.14).

Table 16

Gender-Based Class Size & Nearpod Analysis: 2019-2020

	Gender	n	*M*	*SD*
Total Class Size 2019-2020	Female	168	102.08	59.72
	Male	84	89.73	39.89
Nearpod Total Sessions 2019-2020	Female	168	0.32	2.03
	Male	84	0.00	0.00
Total Class Size 2020-2021	Female	168	20.90	28.86
	Male	84	17.58	22.17
Nearpod Total Sessions 2020-2021	Female	168	39.74	72.35
	Male	84	39.79	87.35
Total Class Size 2021-2022	Female	168	13.99	26.61
	Male	84	16.35	33.51
Nearpod Total Sessions 2021-2022	Female	168	13.96	36.61
	Male	84	13.27	33.14

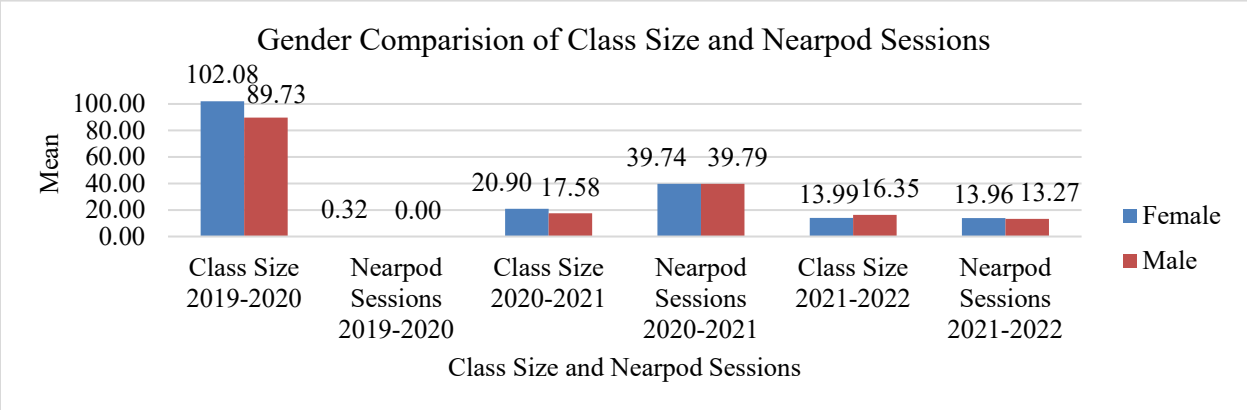

Figure 17: *Gender-Based Class Size & Nearpod Analysis: 2019-2020*

ANOVA: Teacher Race on Age, Experience, Certifications, and Student Count

An analysis of variance (ANOVA) was performed to investigate the effect of teacher race on several factors, such as current age, teaching experience in years, the total number of certifications awarded to teachers in 2019-2020, and the number of students taught during 2019-2020.

According to the statistical findings, teacher race did not have a statistically significant impact on current age as of April 1, 2023 ($F(1, 250) = 2.454$, $p = 0.118$). The between-groups sum of squares was 181.580 ($MS = 181.580$), while the within-groups sum amounted to 18498.749 ($MS = 73.995$), leading to an overall sum of squares of 18680.329 ($df = 251$). In terms of teaching experience measured in years, the data did not indicate a significant effect of teacher race ($F(1, 250) = 0.500$, $p = 0.480$). The between-groups sum of squares equaled 30.283 ($MS = 30.283$), and the within-groups sum was 15136.701 ($MS = 60.547$), resulting in a total sum of squares of 15166.984 ($df = 251$). Additionally, the total number of teacher certifications did not show a statistically meaningful relationship with teacher race ($F(1, 250) = 0.239$, $p = 0.626$). The between-groups sum of squares stood at 0.328 ($MS = 0.328$) and the within-groups sum at 343.386 ($MS = 1.374$), with the entire sum of squares amounting to 343.714 ($df = 251$). Concerning the number of students instructed during the 2019-2020 school year, the results did not suggest any significant effect due to teacher race ($F(1, 250) = 0.013$, $p = 0.908$). The between-groups sum of squares reached 17.166 ($MS = 17.166$), while the within-groups sum was 318062.247 ($MS = 1272.249$), leading to a comprehensive sum of squares of 318079.413 ($df = 251$).

Table 17

Effect of Teacher Race on Teacher Characteristics

		Sum of Squares	*df*	Mean Square	*F*	Sig.
Current Age as of April 1, 2023	Between Groups	181.580	1	181.580	2.454	0.118
	Within Groups	18498.749	250	73.995		
	Total	18680.329	251			
Teaching Experience (Years)	Between Groups	30.283	1	30.283	0.500	0.480
	Within Groups	15136.701	250	60.547		
	Total	15166.984	251			
Total # of Teacher Certification	Between Groups	0.328	1	0.328	0.239	0.626
	Within Groups	343.386	250	1.374		
	Total	343.714	251			
# of Students 2019-2020	Between Groups	17.166	1	17.166	0.013	0.908
	Within Groups	318062.247	250	1272.249		
	Total	318079.413	251			

ANOVA: Teacher Race Effect on Technology-Related Training

According to the statistical analysis, there was no statistically significant effect of teacher race on attendance at technology-related workshops ($F(1, 250) = 2.165$, $p = 0.142$). The between-groups sum of squares was 819.807 ($MS = 819.807$), and the within-groups sum of squares was 94669.761 ($MS = 378.679$), resulting in a total sum of squares of 95489.567 ($df = 251$).

The statistical analysis also revealed no significant effect of teacher race on the total number of hours spent on technology-related activities ($F(1, 250) = 1.556$, $p = 0.213$). The between-groups sum of squares was 1642.528 ($MS = 1642.528$), and the within-groups sum of squares was 263863.526 ($MS = 1055.454$), resulting in a total sum of squares of 265506.054 ($df = 251$).

Table 18

Effect of Teacher Race on Technology-Related Workshops and Hours

		Sum of Squares	df	Mean Square	F	Sig.
Technology-Related Workshops	Between Groups	819.807	1	819.807	2.165	0.142
	Within Groups	94669.761	250	378.679		
	Total	95489.567	251			
Technology-Related Hours	Between Groups	1642.528	1	1642.528	1.556	0.213
	Within Groups	263863.526	250	1055.454		
	Total	265506.054	251			

ANOVA: Teacher Race on Nearpod PD Workshops and Hours

According to the statistical analysis, there was no statistically significant effect of teacher race on attendance at Nearpod workshops for professional development (PD) ($F(1, 250) = 0.933$, $p = 0.335$). The between-groups sum of squares was 1.926 ($MS = 1.926$), and the within-groups sum of squares was 515.737 ($MS = 2.063$), resulting in a total sum of squares of 517.663 ($df = 251$).

Furthermore, the statistical analysis also revealed no significant effect of teacher race on the total number of hours spent on Nearpod PD activities ($F(1, 250) = 1.126$, $p = 0.290$). The between-groups sum of squares was 3.287 ($MS = 3.287$), and the within-groups sum of squares was 729.570 ($MS = 2.918$), resulting in a total sum of squares of 732.857 ($df = 251$).

Table 19

Effect of Teacher Race on Nearpod Workshops and Nearpod Hours

		Sum of Squares	df	Mean Square	F	Sig.
Nearpod Workshops PD	Between Groups	1.926	1	1.926	0.933	0.335
	Within Groups	515.737	250	2.063		
	Total	517.663	251			
Nearpod Hours PD	Between Groups	3.287	1	3.287	1.126	0.290
	Within Groups	729.570	250	2.918		
	Total	732.857	251			

ANOVA: Effect of Teacher Race on Nearpod Sessions and Class Participation (2019-2022)

Furthermore, the researcher explored the effect of teacher race on Nearpod sessions and class participation across three academic years, using the ANOVA with teacher race as the factor. For the 2019-2020 academic year, results indicated no significant effect of teacher race on Nearpod sessions, $F(1, 250) = 0.016$, $p = .900$, with between-groups sum of squares of 0.044 ($MS = 0.044$) and within-groups of 699.809 ($MS = 2.799$). The total sum of squares was 699.853. Similarly, class participation showed no significant effect of teacher race, $F(1, 250) = 0.231$, $p = .631$, with between-groups sum of squares of 680.767 ($MS = 680.767$) and within-groups sum of squares of 735724.837 ($MS = 2942.899$), totaling a sum of squares of 736405.603.

For the 2020-2021 academic year, the Nearpod sessions showed no significant effect of teacher race, $F(1, 250) = 0.138$, $p = .711$, with a between-groups sum of squares of 830.085 ($MS = 830.085$) and within-groups sum of squares of 1506698.661 ($MS = 6026.795$). The total sum of squares was 1507528.746. Class participation also yielded no significant effect of teacher race, $F(1, 250) = 0.014$, $p = .905$, having a between-groups sum of squares of 10.296 ($MS = 10.296$) and a within-groups sum of squares of 180592.382 ($MS = 722.37$). The sum reached a total sum of squares of 180602.679.

For the 2021-2022 academic year, there was no significant effect of teacher race on Nearpod sessions, $F(1, 250) = 0.129$, $p = .720$. The between-groups sum of squares was 162.804 ($MS = 162.804$) and the within-groups sum of squares was 314964.382 ($MS = 1259.858$), with a total sum of squares of 315127.187. Lastly, for class participation, results indicated no significant effect of teacher race, $F(1, 250) = 0.113$, $p = .737$. The between-groups sum of squares was 95.908 ($MS = 95.908$) and the within-groups sum of squares was 211702.199 ($MS = 846.809$), leading to a combined total sum of squares of 211798.107.

Table 20

Teacher Race: Nearpod and Engagement (3 Academic Years)

		Sum of Squares	*df*	Mean Square	*F*	Sig.
Nearpod Sessions 2019-2020	Between Groups	0.365	1	0.365	0.131	0.718
	Within Groups	699.488	250	2.798		
	Total	699.853	251			
Class Participation 2019-2020	Between Groups	904.046	1	904.046	0.307	0.58
	Within Groups	735501.557	250	2942.006		
	Total	736405.603	251			
Nearpod Sessions 2020-2021	Between Groups	35850.039	1	35850.039	6.09	0.014
	Within Groups	1471678.707	250	5886.715		
	Total	1507528.746	251			
Class Participation 2020-2021	Between Groups	20.558	1	20.558	0.028	0.866
	Within Groups	180582.121	250	722.328		
	Total	180602.679	251			
Nearpod Sessions 2021-2022	Between Groups	4235.328	1	4235.328	3.406	0.066
	Within Groups	310891.859	250	1243.567		
	Total	315127.187	251			
Class Participation 2021-2022	Between Groups	360.035	1	360.035	0.426	0.515
	Within Groups	211438.072	250	845.752		
	Total	211798.107	251			

Principal Characteristics

Principal Age and Experience in Lower South Texas (2019-2020)

This study also examined the age and total district experience (in years) of principals in Lower South Texas School District during the 2019-2020 academic school year. Descriptive statistics were calculated for both variables based on data collected from 10 participants. For age, the range was 15 years, with the youngest participant being 41 years old and the oldest being 56 years old. The mean age of the participants was 48.70 years (M = 48.70, SD = 6.09). In terms of total district experience, the range was 32 years, with participants having between 1 and 33 years of district experience. On average, the participants had 21.40 years of experience (M = 21.40, SD = 10.22).

Table 21

Age and Total District Experience of Middle School Principals

	n	Range	Min	Max	*M*	*SD*
Principal Age	10	15	41	56	48.70	6.093
Total District Experience	10	32	1	33	21.40	10.222

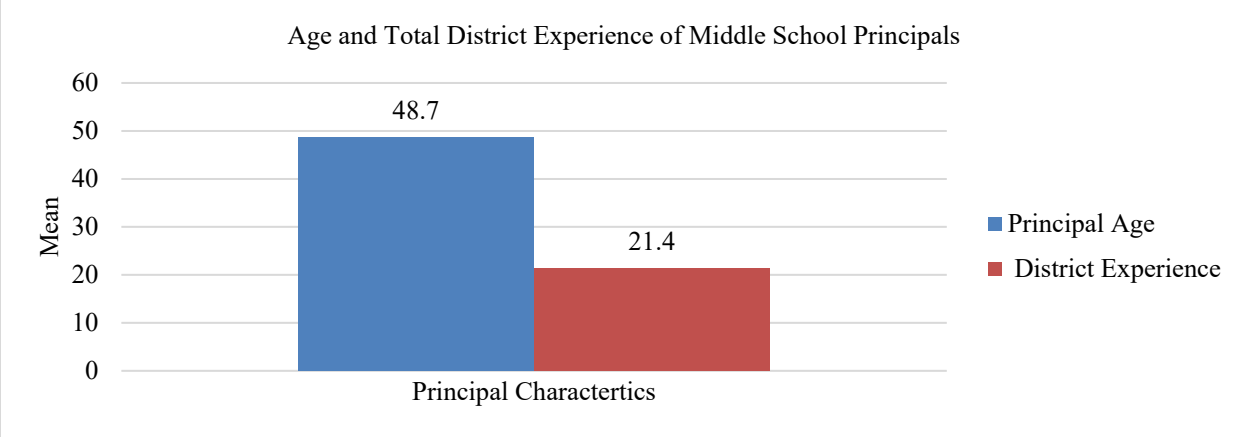

Figure 18: *Age and Total District Experience of Middle School Principals*

Gender Differences in Principals' Characteristics

The descriptive statistics for principal gender and characteristics revealed that among the 10 principals included in the study, 6 (60%) were identified as female, while 4 (40%) were identified as male, indicating a majority of female principals during the 2019-2020 academic school year. The sample of principals included females with ages ranging from 41 to 56 years (M = 48.67, SD = 6.31) and males with ages ranging from 42 to 55 years (M = 48.75, SD = 6.70). Furthermore, the sample consisted of 6 female principals, whose total district experience ranged from 1 to 33 years (M = 21.33, SD = 11.46), and 4 male principals with total district experience ranging from 9 to 31 years (M = 21.50, SD = 9.71).

Table 22

Gender Distribution among Middle School Principals

	n	Percent	Cumulative Percent
Females	6	60.0	60.0
Male	4	40.0	100.0

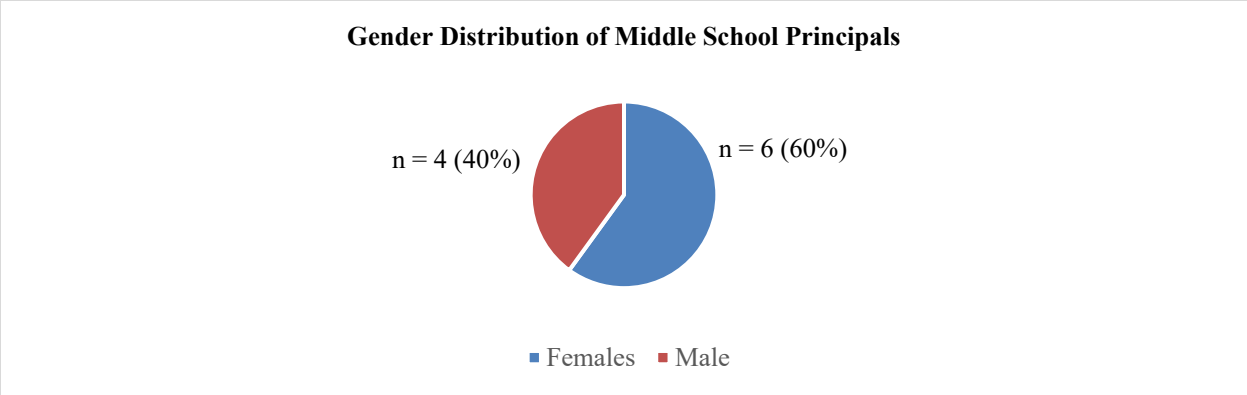

Figure 19: *Gender Distribution among Middle School Principals*

Table 23

Gender and Mean Age Distribution of Middle School Principals

	n	Min	Max	*M*	*SD*
Female	6	41	56	48.67	6.31
Male	4	42	55	48.75	6.70

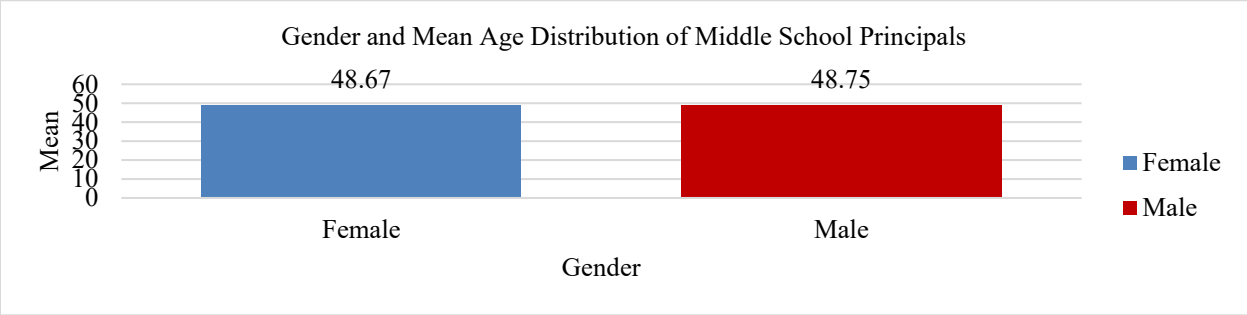

Figure 20: *Gender and Mean Age Distribution of Middle School Principals*

Table 24

Gender and Mean Total District Experience of Middle School Principals

	n	Min	Max	*M*	*SD*
Female	6	1	33	21.33	11.466
Male	4	9	31	21.50	9.713

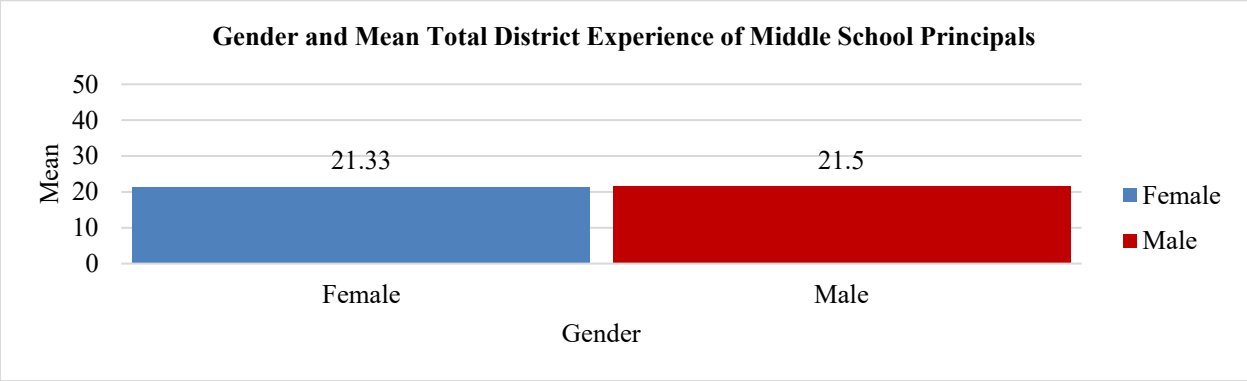

Figure 21: *Gender and Mean Total District Experience of Middle School Principals*

Principal Metrics by Gender: Technology and School Dynamics (2019-2020)

An analysis of characteristics of principals' technology involvement, student enrollment, student-teacher ratio, total number of teachers, and average teaching experience was conducted for the 2019-2020 academic year. Based on the gender of the principals, females, and males were compared.

The analysis included six female principals who attended an average of 4.50 technology-related workshops (n = 6, *M* = 4.50, *SD* = 3.61). A total of 6.41 technology-related hours were recorded (*M* = 6.41, *SD* = 3.41). Student enrollment ranged from 681 to 1152 students, with an average enrollment of 858.67 students (*M* = 858.67, *SD* = 187.46). Among female principals, the student-to-teacher ratio (*M* = 14, *SD* = 0.89), with a mean of 14 students per teacher. A total of 60.67 teachers were under the supervision of female principals (*M* = 60.67, *SD* = 10.23). Lastly,

a teacher under female principal supervision's teaching experience during the 2019-2020 academic year (M = 16.87, SD = 1.81).

A total of four male principals were included in the analysis. There were an average of 6.25 (n = 4, M = 6.25, SD = 4.57) technology-related workshops attended by male principals. A mean of 13.5 hours (M = 13.5, SD = 18.50) were recorded for technology-related hours. There was an average enrollment of 990.5 (M = 990.5, SD = 134.00) students. Among male principals, the student-to-teacher ratio had mean of 15.5 students per teacher (M = 15.5, SD = 1.29). There were 59 to 70 teachers under the supervision of male principals, with an average of 63.75 teachers (M = 63.75, SD = 5.18). Finally, the average teacher-teaching experience of male principal supervisors during the 2019-2020 academic year average of 15.46 years (M = 15.46, SD = 2.47).

For the academic year of 2019-2020, characteristically different trends emerged between female and male principals' behaviors in various domains. Among six female principals (n = 6, M = 4.50), female principals participated less in technology-related workshops than male principals (M = 6.25). In addition, female principals spent fewer hours on technology-related activities on average (M = 6.41) than their male counterparts (M = 13.50). On average, male principals had a higher student enrollment (M = 990.50) than female principals (M = 858.67). Students-to-teacher ratios for female principals (M = 14) were slightly lower than those for male principals (M = 15.5). Furthermore, male principals had a higher average number of teachers under supervision (M = 63.75) than female principals (M = 60.67). Additionally, female, and male principal supervision had similar teacher-teaching experiences, with an average of 16.87 (M = 16.87) years for female principals and 15.46 (M = 15.46) years for male principals. This data highlights significant gender differences in technology involvement, student enrollment figures

maintained by the leadership structure, and how managerial responsibilities are distributed across various genders within this district over a specified academic year.

Table 25

Technology and Education Means: Principal Gender – Focused Metrics

		M	*SD*
Female	Principal Total Technology-Related Workshops	4.5	3.61
	Principal Total Technology-Related Hours	6.41	3.41
	Student Enrollment	858.67	187.46
	Students per Teacher	14	0.89
	Total Teacher	60.67	10.23
	Teaching Experience Avg	16.87	1.81
Male	Principal Total Technology-Related Workshops	6.25	4.57
	Principal Total Technology-Related Hours	13.50	18.50
	Student Enrollment	990.50	134.00
	Students per Teacher	15.50	1.29
	Total Teacher	63.75	5.18
	Teaching Experience Avg	15.46	2.47

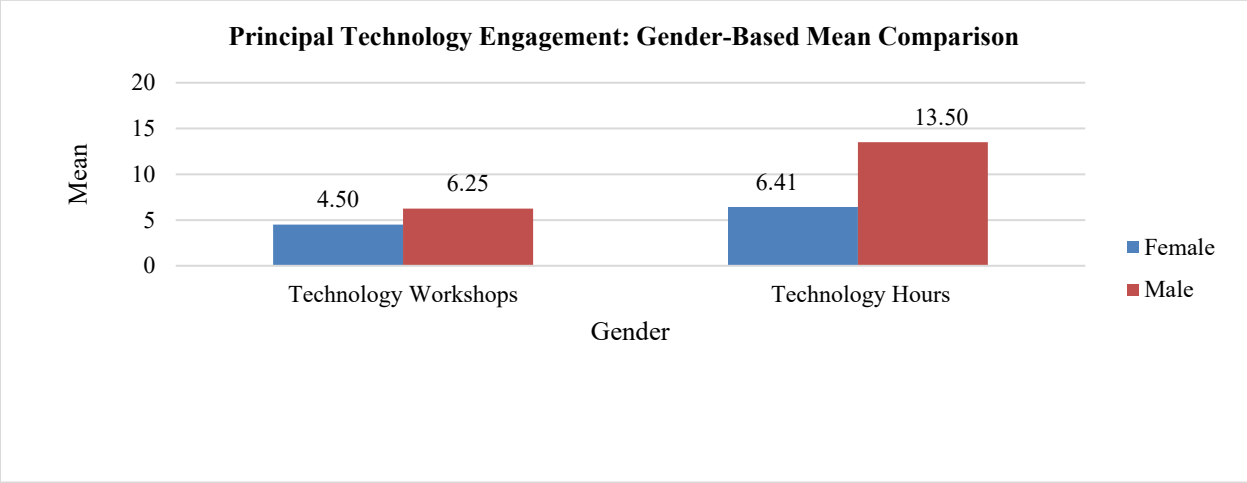

Figure 22: *Principal Technology Engagement: Gender-Based Mean Comparison*

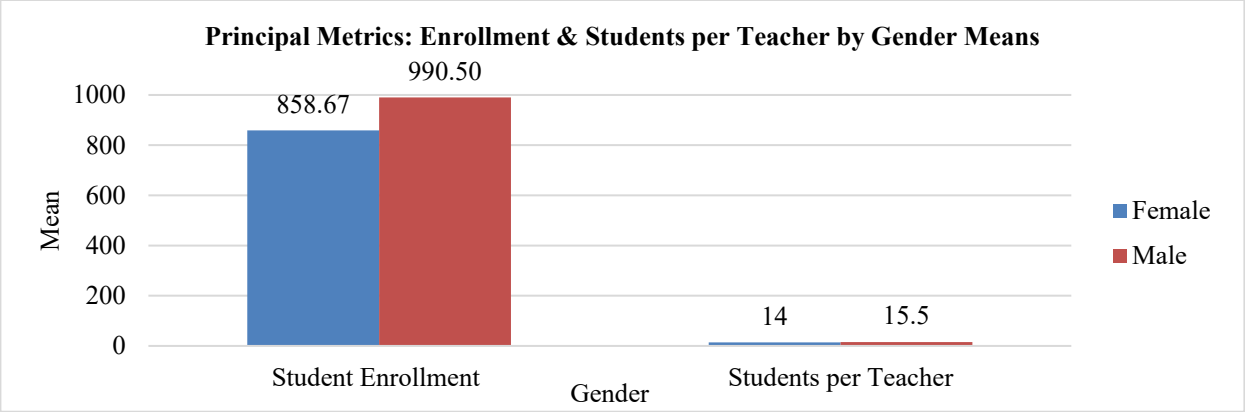

Figure 23: *Principal Metrics: Enrollment & Students per Teacher by Gender Means*

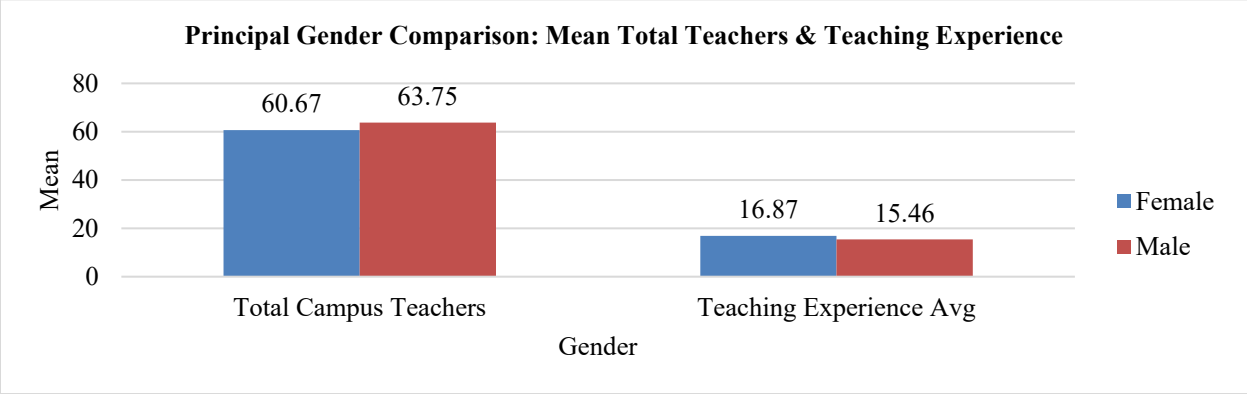

Figure 24: *Principal Gender Impact on Teacher Count and Teaching Experience*

Campus Software Application Analysis: Distribution and Variation

The frequency table resulting from an analysis of the total number of applications used by ten campuses over three consecutive academic years (2019-2020, 2020-2021, and 2021-2022) provides insights into the distribution of applications.

The dataset had no missing values, indicating that all campuses provided valid information. Across the three years, the mode representing the most frequent value exhibited variations. The mode for the 2019-2020 academic year was 60 software applications. In the following year, the mode increased to 247 software applications; in the final year (2021-2022), it further increased to 248.

An analysis of the range, representing the difference between maximum and minimum values, revealed fluctuations over time. The number of applications decreased from 95 (2019-2020) to 62 (2020-2021) and then to 44 (2021-2022). Each campus used a minimum of 60, 196, and 207 software applications. However, the maximum number of software applications reached 155, 258, and 251.

Table 26

Distribution of Total Apps: Mode Across Academic Years

	Total Apps in 2019-2020	Total Apps in 2020-2021	Total Apps in 2021-2022
Mode	60	247	248
Skewness	-0.303	-1.232	-0.412
Std. Error of Skewness	0.687	0.687	0.687
Range	95	62	44
Minimum	60	196	207
Maximum	155	258	251

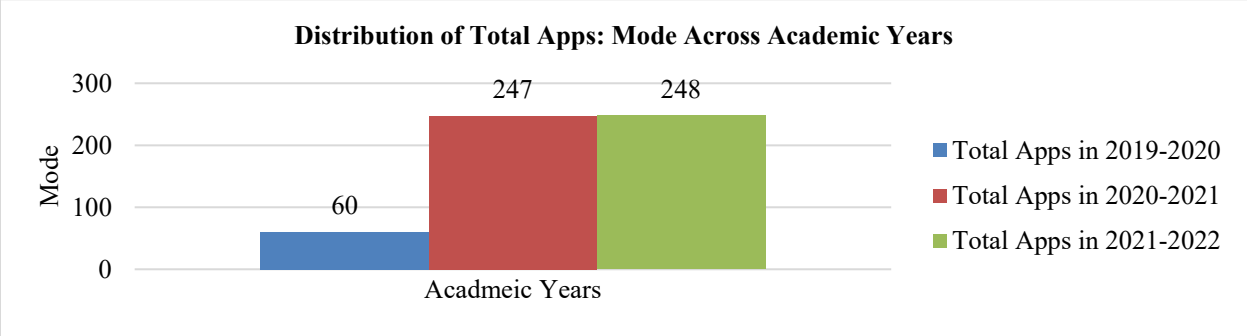

Figure 25: *Distribution of Total Apps: Mode Across Academic Years*

Digital Shifts: Middle Schools' Platform Use During COVID-19 (2019-2022)

During the COVID-19 pandemic, middle schools in the Lower South Texas School District experienced fluctuations in their use of digital educational platforms. Based on data from this district, the top 10 platforms adopted during the 2019-2020 school year included CommonLit, DocHub, Education Galaxy, Google Classroom, Imagine Edgenuity/MyPath, Lexia Core5, Nitro Type, PBS Kids, Pearson Math XL, and Vocabulary.com. Each platform had

notable usage, reflecting the diverse digital tools educators turned to during these unprecedented times.

However, a clear frontrunner application emerged in the following academic year, 2020-2021. Google Meets became the choice across all schools in the district, with an unmatched usage rate of 100%. It stood out as the top app during that school year. In the year 2021–2022, Google Classroom, Imagine Edgenuity / MyPath, Lexia PowerUp, and Schoology took the lead as the popular digital educational platforms in middle schools. Google Classroom had usage in 2 schools, accounting for 20% of usage. Similarly, Imagine Edgenuity / MyPath and Lexia PowerUp were utilized by three schools, each contributing to 30.0% usage for each platform across all schools. Lastly, IXL and Schoology were employed by one school, each representing 10% usage for both platforms.

These findings highlight the changing nature of educational platform usage during the COVID-19 pandemic. The noticeable shift, from a range of platforms used in the 2019-2020 year to the widespread adoption of Google Meet in the 2020-2021 academic year emphasized the urgent requirement for video conferencing tools to facilitate smooth remote instruction. Additionally, the diverse usage of platforms like Google Classroom, Imagine Edgenuity / MyPath, IXL, Lexia PowerUp and Schoology in the 2021-2022 year demonstrated a combination of established platforms and tailored resources to meet the specific needs of middle schools, within the district.

Table 27

Top Digital Platforms in Middle Schools: COVID-19 Pandemic (3 Years)

Academic Year	Platform	Logo	n	Percent
2019-2020	CommonLit		1	10.00%
2019-2020	DocHub		1	10.00%
2019-2020	Education Galaxy		1	10.00%
2019-2020	Google Classroom		1	10.00%
2019-2020	Imagine Edgenuity / MyPath		1	10.00%
2019-2020	Lexia Core5		1	10.00%
2019-2020	Nitro Type		1	10.00%
2019-2020	PBS Kids		1	10.00%
2019-2020	Pearson Math XL		1	10.00%
2019-2020	Vocabulary.com		1	10.00%
2020-2021	Google Meet		10	100.00%
2021-2022	Google Classroom		2	20.00%
2021-2022	Imagine Edgenuity / MyPath		3	30.00%
2021-2022	IXL		1	10.00%
2021-2022	Lexia PowerUp		3	30.00%
2021-2022	Schoology		1	10.00%

Correlation Analysis: Principal Involvement and School Trends (2019-2020)

A Pearson correlation analysis was conducted to examine the relationships among the variables for the academic school year 2019-2020. From the Pearson correlation table, several significant correlations emerged, offering valuable insights into the relationships between different variables.

A strong, significant positive correlation was observed between the number of technology-related workshops attended by principals and the number of technology-related workshops attended on their campuses, as evidenced by $r(10\text{-}2) = .756$, $p = .011$. This result emphasizes the association between principals' active participation in technology workshops and their commitment to promoting technology in their respective school environments.

Additionally, when analyzing the correlation between principal technology-related workshops attended and total apps a Pearson correlation coefficient of $r(10\text{-}2) = 0.091$, $p = 0.803$. This weak positive correlation suggests that there is a non-significant relationship between the level of principals' involvement in technology workshops and the overall usage of applications in their respective campuses. The $p = 0.803$ indicates that the observed weak positive correlation is not statistically significant at the 0.05 significance level. Therefore, it can be concluded that variations in principals' workshop participation do not consistently correspond to differences in the adoption of apps across schools.

The correlation analysis provided insights, revealing a strong positive correlation between the number of teachers and student enrollment. This was evidenced by the Pearson correlation coefficient of $r(10\text{-}2) = .947$, $p < .001$. This result underscores the strong positive correlation between the number of teachers and the student population, emphasizing the intrinsic relationship between these two crucial factors in education.

A moderate positive correlation, which was not statistically significant, was observed between principal technology-related workshops attended and teachers' average teaching experience, as evidenced by a Pearson correlation coefficient of $r(10\text{-}2) = 0.317$, $p = 0.373$. This implies that there is no strong or meaningful relationship between the level of involvement of school principals in technology-related workshops and the average teaching experience of the teachers in the school.

Moreover, a strong positive correlation was identified between Student Enrollment and Students per Teacher, as indicated by a Pearson correlation coefficient of $r(10\text{-}2) = .805$, $p < .005$. This finding suggests that as the student enrollment in the school rises, there is a tendency for the student-teacher ratio (students per teacher) to concurrently increase.

Table 28

Correlation Analysis of Educational Factors for Academic Year 2019 -2020

			1	2	3	4	5	6	7
1.	Principal Tech Workshops	Pearson Correlation Sig. (2-tailed) N	-						
2.	Campus Tech Workshops	Pearson Correlation Sig. (2-tailed) N	.756* 0.011 10	-					
3.	Total Teacher	Pearson Correlation Sig. (2-tailed) N	-0.058 0.874 10	-0.139 0.702 10	-				
4.	Teacher Average Teaching Experience	Pearson Correlation Sig. (2-tailed) N	0.317 0.373 10	0.285 0.425 10	0.195 0.589 10	-			
5.	Student Enrollment	Pearson Correlation Sig. (2-tailed) N	-0.064 0.860 10	-0.026 0.943 10	.947** 0.000 10	0.121 0.738 10	-		
6.	Students per Teacher	Pearson Correlation Sig. (2-tailed) N	-0.118 0.746 10	0.157 0.665 10	0.575 0.082 10	-0.016 0.965 10	.805** 0.005 10	-	
7.	Total Apps	Pearson Correlation Sig. (2-tailed) N	0.091 0.803 10	0.317 0.372 10	.740* 0.014 10	0.314 0.376 10	.802** 0.005 10	.696* 0.025 10	-

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Correlation Analysis: Principal Involvement and School Trends (2020-2021)

A Pearson correlation analysis was conducted to examine the relationships among the variables for the academic school year 2020-2021. A strong positive correlation was found between the number of principal technology-related workshops attended and campus technology-related workshops attended, as indicated by a coefficient of $r(10\text{-}2) = 0.561$, $p = 0.091$. This suggests a positive relationship between the level of engagement of principals and that of their respective campuses in technology-related workshops.

In terms of the relationship between principal technology-related workshops attended and total teachers, no correlation emerged, as denoted by $r(10\text{-}2) = -0.307$, $p = 0.388$. While the correlation was not statistically significant, it implies that schools with higher principal workshop participation tended to have fewer total teachers. Additionally, no correlation between

principal technology-related workshops and teacher average teaching experience was observed, indicated by $r(10\text{-}2) = -0.466$, $p = 0.175$. This finding implies that principals who participated more in technology-related workshops tended to lead schools with teachers who, on average, had less teaching experience.

A nonsignificant correlation was observed between principal technology-related workshops attended and total apps, as evidenced by $r(10\text{-}2) = 0.264$, $p = 0.462$. This indicates that schools with more active principals in technology workshops tended to exhibit higher utilization of digital applications. While not statistically significant, this trend might have practical implications for digital integration in school settings.

Table 29

Correlation Analysis of Educational Factors for Academic Year 2020 -2021

			1	2	3	4	5	6	7
1.	Principal Tech Workshops	Pearson Correlation	-						
		Sig. (2-tailed)							
		N							
2.	Campus Tech Workshops	Pearson Correlation	0.561	-					
		Sig. (2-tailed)	0.091						
		N	10						
3.	Total Teacher	Pearson Correlation	-0.307	0.031	-				
		Sig. (2-tailed)	0.388	0.932					
		N	10	10					
4.	Teacher Average Teaching Experience	Pearson Correlation	-0.466	0.129	0.282	-			
		Sig. (2-tailed)	0.175	0.722	0.429				
		N	10	10	10				

Table 29: Continued

			1	2	3	4	5	6	7
5.	Student Enrollment	Pearson Correlation	0.598	0.465	-0.314	0.197	-		
		Sig. (2-tailed)	0.068	0.176	0.378	0.585			
		N	10	10	10	10			
6.	Students per Teacher	Pearson Correlation	-0.139	0.370	0.559	0.248	-0.047	-	
		Sig. (2-tailed)	0.702	0.293	0.093	0.490	0.898		
		N	10	10	10	10	10		
7.	Total Apps	Pearson Correlation	0.264	0.431	.748*	0.102	0.206	0.399	-
		Sig. (2-tailed)	0.462	0.213	0.013	0.780	0.568	0.254	
		N	10	10	10	10	10	10	

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Correlation Analysis: Principal Involvement and School Trends (2021-2022)

A Pearson correlation analysis was conducted to examine the relationships among the variables for the academic school year 2021-2022. The correlation between principal total technology-related workshops attended, and campus total technology-related workshops attended was notably strong, at $r(10\text{-}2) = 0.791$, $p = 0.006$. This positive correlation suggests that when principals actively participate in technology workshops, they increase their school participation.

Furthermore, a moderate, non-significant positive correlation was observed between the number of technology-related workshops attended by principals and the total number of teachers, as indicated by $r(10\text{-}2) = 0.400$, $p = 0.252$. Although not statistically significant, this relationship contributes to our understanding of the interactions between these factors.

Similarly, a correlation between principal total technology-related workshops attended and teacher average teaching experience emerged $r(10\text{-}2) = 0.316$, $p = 0.374$. This indicates a positive correlation between principal workshop involvement and the average teaching experience of the school's teachers. While the statistical significance may not be evident, this insight can contribute to discussions about how professional development might impact the teaching workforce.

The correlation between principal total technology-related workshops attended and student enrollment was negative but minimal $r(10\text{-}2) = -0.058$, $p = 0.873$. In addition, a positive correlation between principal total technology-related workshops and total apps was observed $r(10\text{-}2) = 0.304$, $p = 0.393$.

Table 30

Correlation Analysis of Educational Factors for Academic Year 2021-2022

			1	2	3	4	5	6	7
1.	Principal Tech Workshops	Pearson Correlation	-						
		Sig. (2-tailed)							
		N							
2.	Campus Tech Workshops	Pearson Correlation	.791**	-					
		Sig. (2-tailed)	0.006						
		N	10						
3.	Total Teacher	Pearson Correlation	0.400	0.530	-				
		Sig. (2-tailed)	0.252	0.115					
		N	10	10					
4.	Teacher Average Teaching Experience	Pearson Correlation	0.316	0.528	0.268	-			
		Sig. (2-tailed)	0.374	0.117	0.454				
		N	10	10	10				
5.	Student Enrollment	Pearson Correlation	-0.058	-0.110	-0.284	0.315	-		
		Sig. (2-tailed)	0.873	0.762	0.427	0.375			
		N	10	10	10	10			
6.	Students per Teacher	Pearson Correlation	0.278	0.396	0.576	0.428	0.220	-	
		Sig. (2-tailed)	0.436	0.258	0.082	0.217	0.541		
		N	10	10	10	10	10		
7.	Total Apps	Pearson Correlation	0.304	0.248	.748*	0.176	0.201	0.543	-
		Sig. (2-tailed)	0.393	0.490	0.013	0.626	0.577	0.105	
		N	10	10	10	10	10	10	

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Technology Workshop Trends: Principal and Campus Engagement Over Three Years

By examining the correlation patterns across the years from 2019-2020, 2020-2021, and 2021-2022 one can uncover a variety of trends and dynamics. These insights offer an understanding of the relationships between different variables. While some correlations display a level of consistency over time others demonstrate changes and transformations providing a holistic view of how these correlations evolved.

During the year 2019-2020, there was a finding between the participation of principals and campuses in technology workshops attended $r(10\text{-}2) = .756$, $p = .011$. This suggests there was alignment between school principal involvement and their respective campuses in technology workshops. In the year 2020-2021, the positive relationship continued $r(10\text{-}2) = 0.561$, $p = 0.091$ although it weakened slightly. In the academic year 2021-2022, there was an increase in the correlation between principals' technology-related workshops and campus technology related workshops $r(10\text{-}2) = 0.791$, $p = 0.006$. This stronger correlation highlights a relationship between the involvement of principals and campuses in technology workshops.

To summarize, the relationship between principals' technology-related workshops attended and campus technology workshops attended became more intense over time. These changing patterns of correlation highlight the interaction between principals' technology-related workshops attended, and campuses technology-related workshops attended in shaping technology involvement demonstrating the ability of environments to adapt and thrive.

Learning Online: Technology-Related Professional Development Survey Results

A Qualtrics survey was conducted to examine teachers' experiences with technology-related professional development in the context of online learning. For data collection, the survey was called "Learning Online: Technology-Related Professional Development" and emailed to principals. After receiving the survey link, the principals forwarded it to their core content teachers. Using this approach, the study aimed to understand teachers' perspectives and experiences related to technology-related professional development in online learning.

Participant Demographics: Insights from a Teacher Survey

The survey presents and explores findings gained from a survey with 57 middle school core subject teachers participating as respondents. A total of 40 teachers answered questions about their gender identity. Ten (18%) of the teachers identified as male, 27 (47%) as female, three (5%) did not disclose their gender identity, and 17 (30%) were missing values for the gender identity variable. A total of 36 (63%) teachers identified as White, while two teachers (4%) selected "Other" as their race. Additionally, there were 19 missing race values, accounting for 33% of all teachers. Of the 19 (33%) teachers who reported having a 4-year degree, 17 (30%) teachers reported having a master's degree, and 2 (4%) teachers reported having a Doctorate. Additionally, 19 (33%) teachers did not provide information about their highest degree level.

Among the 57 participants, 11 (20%) taught at the 6th-grade level, 7 (12%) taught at the 7th-grade level, and 16 (28%) taught at the 8th-grade level. Seven (12%) teachers indicated they taught a combination of grade levels, and 16 (28%) of the participants' data needed to be included regarding their grade-level assignments. Of the 57 teachers, 24 (42%) reported majoring in their current teaching assignments during their undergraduate studies. At the same time, 14 (25%) indicated that they did not major in their current teaching assignment. There were 19 (33%) missing data for this variable.

Table 31

Gender Characteristics of Respondents

Gender	n	Percent
Male	10	18
Female	27	47
Prefer not to say	3	5
Total	40	70
Missing Information	17	30
Total	57	100

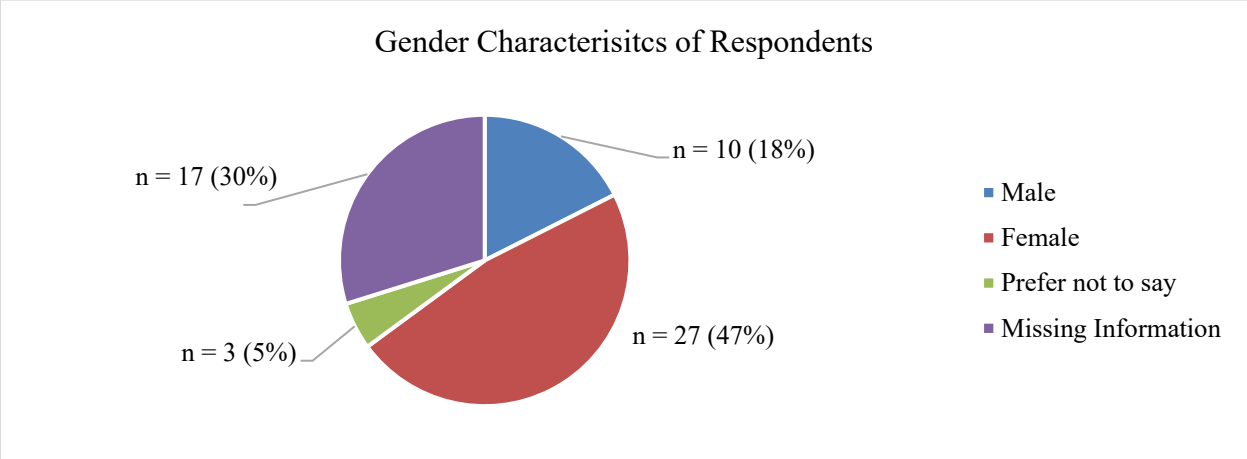

Figure 26: *Gender Characteristics of Respondents*

Table 32

Race of Respondents

Race	n	Percent
White	36	63
Other	2	4
Missing Information	19	33

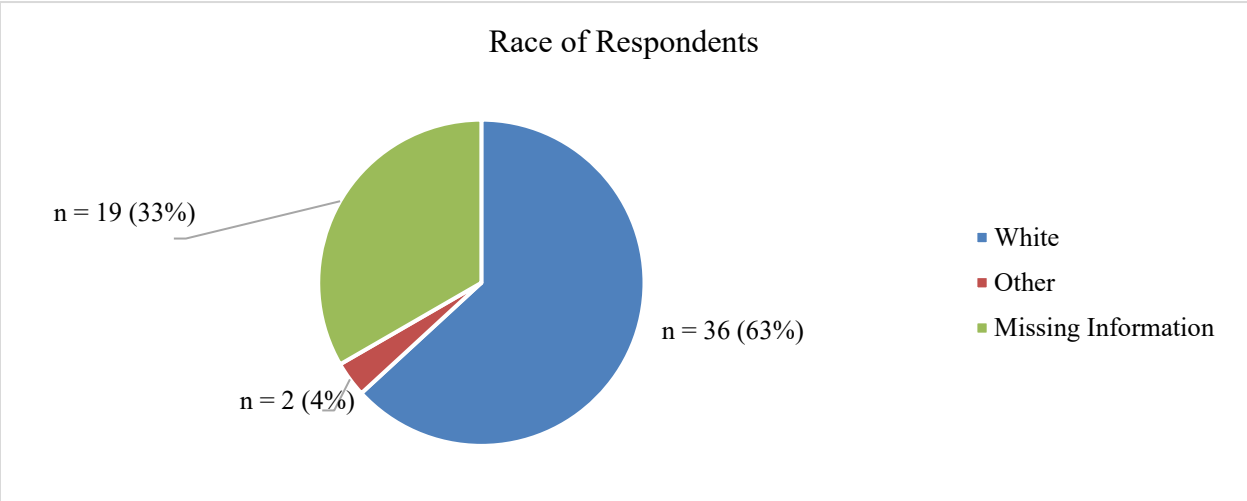

Figure 27: *Race of Respondents*

Table 33

Respondents Highest Degree Obtained

Degree	n	Percent
4-year degree	19	33
Master's degree	17	30
Doctorate	2	4
Missing Information	19	33

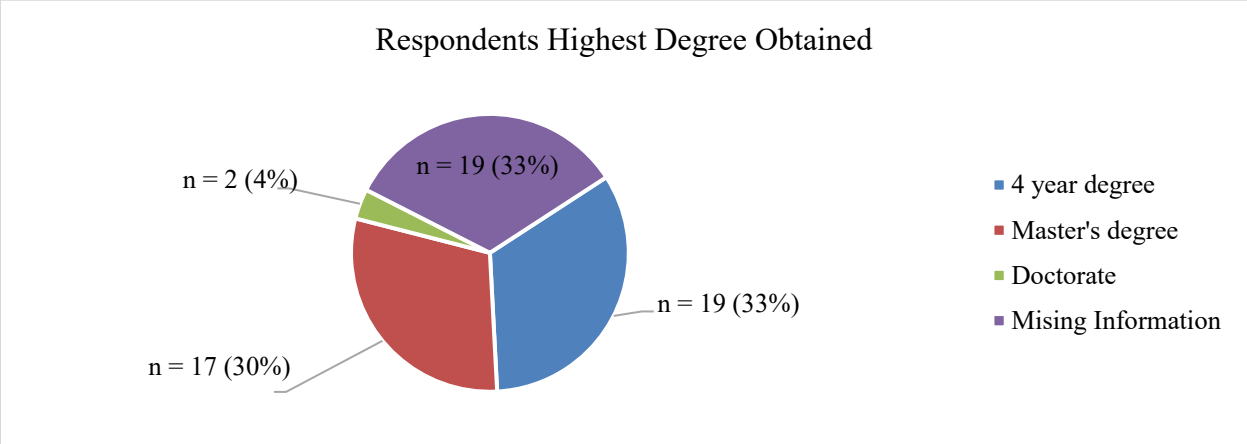

Figure 28: *Respondents Highest Degree Obtained*

Table 34

Distribution of Grade Levels Among Teachers in Their Teaching Assignments

Grade Level	n	Percent
6th	11	20
7th	7	12
8th	16	28
Combination of grade levels	7	12
Missing Information	16	28

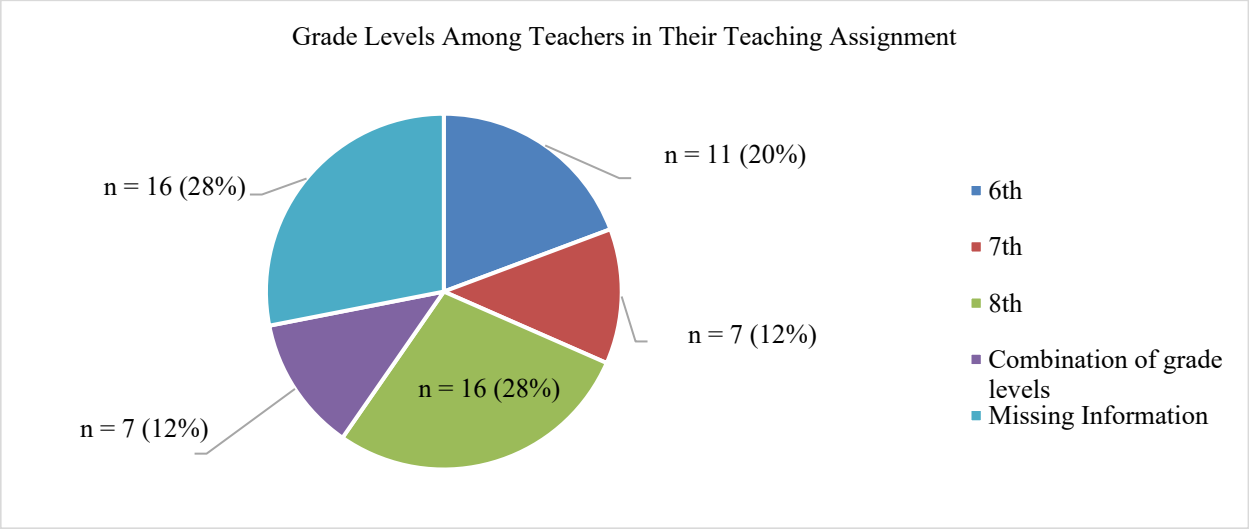

Figure 29: *Distribution of Grade Levels Among Teachers in Their Teaching Assignments*

Perceptions of Professional Development and Technology Comfort During COVID-19

Teachers were asked to rate their agreement with several statements on a 5-point Likert scale. For the first statement, "Overall, I feel that I am growing professionally as a result of the professional development opportunities offered in my district," on a 5-point scale where 1 = *strongly disagree*, 2 = *somewhat disagree*, 3 = *neither agree nor disagree*, 4 = *somewhat agree*, and 5 = *strongly agree*. The mean response was (M = 4.18, SD = 0.96), based on 50 respondents, indicating a response of somewhat agree.

For the second statement, "My profession allows me to learn and develop new skills to enhance classroom instruction," the mean response was (M = 4.36, SD = 0.87), based on 50 respondents, suggesting a response closer to strongly agree.

Teachers were asked to rate their preparedness to remotely teach before and after school closure due to COVID-19 on a 5-point Likert scale: 1 = *not prepared at all*, 2 = *slightly prepared*, 3 = *moderately prepared*, 4 = *very prepared* and 5 = *extremely prepared*. For the question, "How prepared were you to remotely teach your assignment before school closure due

to COVID-19?" the mean response was (*M* = 2.14, *SD* = 0.99), based on 50 respondents, indicating a response between slightly prepared. For the follow-up question, "Do you feel prepared to teach remotely after COVID-19 if your assignment requires it?" the mean response was (*M* = 3.96, *SD* = 0.80), based on 50 respondents, indicating a response closer to very prepared.

Teachers were then asked to rate their comfort level using technology in their classroom before, during, and after COVID-19 on a 5-point Likert scale from 1 = *extremely uncomfortable*, 2 = *somewhat uncomfortable*, 3 = *neither comfortable nor uncomfortable*, 4 = *somewhat comfortable*, 5 = *extremely comfortable*. For the question, "Before COVID-19, how comfortable did you feel using technology in your classroom?" The mean response was (*M* = 3.58, *SD* = 1.07), based on 45 respondents, indicating a response of somewhat comfortable.'

For the question, "During COVID-19, how comfortable did you feel using technology in your classroom?" The mean response was (*M* = 3.80, *SD* = 1.01), based on 45 respondents, indicating a response closer to somewhat comfortable. For the question, "After COVID-19, how comfortable are you using technology in your classroom?" The mean response was (*M* = 4.36, *SD* = 0.95), based on 45 respondents, indicating a response closer to extremely comfortable.

Table 35

Mean Responses to Survey Questions

Variable	n	Mean	SD
Overall, I feel that I am growing professionally	50	4.18	0.962
My profession allows me to learn and develop new skills	50	4.36	0.875
How prepared were you to remotely teach before COVID-19	50	2.14	0.99
Do you feel prepared to teach remotely after COVID-19	50	3.96	0.807
Before COVID-19, how comfortable did you feel using technology	45	3.58	1.076
During COVID-19, how comfortable did you feel using technology	45	3.80	1.014
After COVID-19, how comfortable are you using technology	45	4.36	0.957

Technology Integration in Instruction: Descriptive Statistics Overview

The descriptive statistics about the integration frequency of various technologies within classroom instruction encompass the question, "How often do you integrate the following technologies into your classroom instruction?" and are separated into distinct technology categories. Each examined variable comprises a sample size (n = 40) of participants.

The mean integration frequency for chrome books and laptops employed for assignments was calculated with a corresponding standard deviation (*M* = 18.15, *SD* = 0.975). Similarly, the mean integration frequency for presenting lessons via smartboards or interactive panels was (*M* =18.15, *SD* = 1.075). Moreover, the variable gauging the integration of Internet use as part of lessons yielded (*M* = 17.80, *SD* = 1.091. Lastly, the category involving students' creation of Google Slide or PowerPoint presentations exhibited a mean of (*M* = 16.56, *SD* = 1.252).

Table 36

Analysis of Technology Integration Frequency in Classroom Instruction

Variable	n	*M*	*SD*	Min	Max
How often do you integrate the following technologies into your classroom instruction? - Have students use chrome books, laptops for assignments	40	18.15	0.975	15	19
How often do you integrate the following technologies into your classroom instruction? - Present lessons using a smartboard, interactive panel	40	18.15	1.075	16	19
How often do you integrate the following technologies into your classroom instruction? - Have students use the Internet as part of their lesson	40	17.80	1.091	16	19
How often do you integrate the following technologies into your classroom instruction? - Have students create a Google Slide or PowerPoint presentation	40	16.56	1.252	15	19

Online Assessment Tools Before and After COVID-19

A descriptive analysis examined the frequencies and percentages of tools used for educational assessment in the classroom before and after the COVID-19 pandemic. Before COVID-19, the most utilized tools were Nearpod 13 (22.8%), Microsoft Office 365 13 (22.8%), Google Suite 10 (17.5%), None (indicating no specific tool used) 13 (22.8%), Other (indicating other digital tools) 7 (12.3%), and Schoology 6 (10.5%).

After the COVID-19 pandemic, there was a significant increase in the utilization of online assessment tools. The highest percentage of tools used were Nearpod 29 (50.9%), Google Suite 22 (38.6%), and Microsoft Office 365 21(36.8%). Schoology continued to be used by 14 (24.6%) of teachers, while the percentage of teachers using Other 14 (24.6%).

The results indicate that after the COVID-19 pandemic, there was a noticeable change in the use of assessment tools in the classroom. Nearpod, Google Suite, and Microsoft Office 365 were the most popular platforms used for educational assessment. Although some participants still used Schoology, its usage was relatively lower. These findings emphasize the growing reliance on digital platforms and the flexibility they provided for conducting educational assessments during the pandemic.

Table 37

Online Tools Usage Before and After COVID-19 by Teachers

BEFORE COVID-19	n	Percent	After COVID-19	n	Percent
Google Suite	10	17.5	Google Suite	22	38.6
Microsoft Office 365	13	22.8	Microsoft Office 365	21	36.8
Nearpod	13	22.8	Nearpod	29	50.9
Schoology	6	10.5	Schoology	14	24.6
None	13	22.8			
Other, please specify	7	12.3	Other, please specify	14	24.6

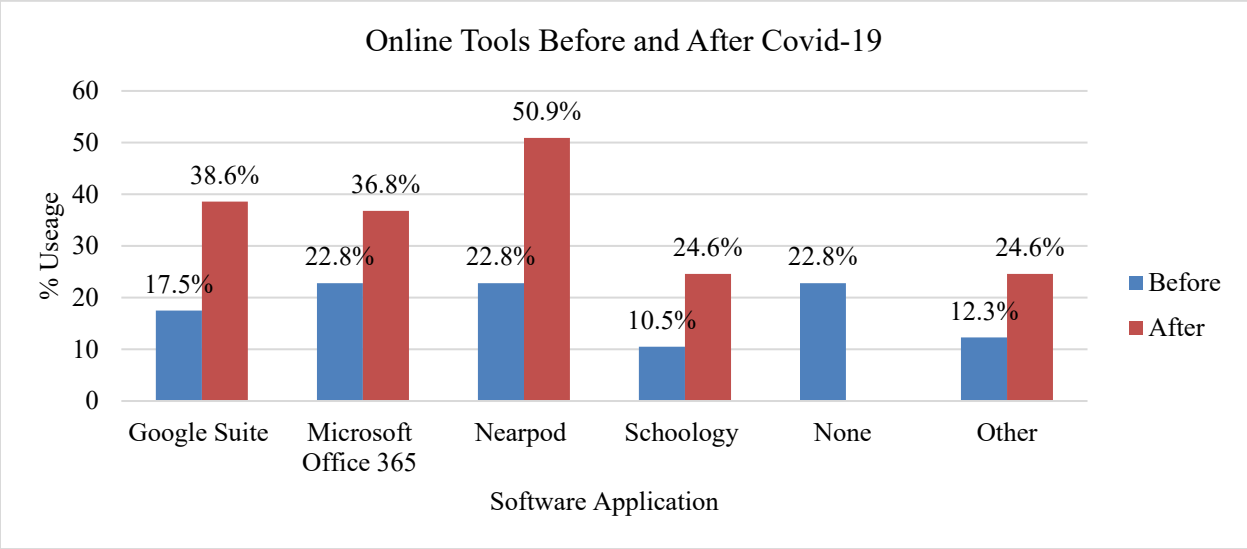

Figure 30: *Online Tools Usage Before and After COVID-19*

Professional Development's Impact on Teacher Confidence in Remote Instruction

A Pearson correlation was conducted to examine the relationship between stages of professional development and how educators perceive their preparedness in dealing with the difficulties of remote teaching. By analyzing correlation coefficients and their corresponding significance levels, we sought to shed light on these relationships.

A positive correlation exists between teachers participating in professional development sessions before the COVID-19 pandemic and their confidence in being prepared for remote teaching $r(50\text{-}2) = 0.574$, $p < 0.001$. This finding highlights the importance of professional development in helping educators feel more confident and capable when transitioning to remote instructional methods. Furthermore, the research discovered a correlation between educators engaging in online professional development amidst the COVID-19 pandemic and their expressed preparedness for remote teaching.

However, the correlation between teachers' involvement in online professional development after the COVID-19 pandemic and their perceived preparedness for remote teaching was comparatively weaker $r(50\text{-}2) = 0.188$, $p = 0.191$. Professional development programs had an impact on teachers' ability to teach remotely after the pandemic. However, this impact was not as strong as before and during the pandemic.

In summary, the correlation coefficients highlight the role of online professional development in helping educators effectively handle the challenges of remote instruction. The research emphasized the significance of professional development in preparing educators to embrace remote teaching practices during the pandemic and in the future.

Table 38

Online Professional Development and Remote Teaching Preparedness

			1	2	3
1.	The online professional development offered before COVID-19 prepared me to teach students remotely?	Pearson Correlation Sig. (2-tailed) N	-		
2.	The online professional development offered during COVID-19 prepared me to teach students remotely?	Pearson Correlation Sig. (2-tailed) N	.574** 0.000 50	-	
3.	The online professional development offered after COVID-19 prepared me to teach students remotely?	Pearson Correlation Sig. (2-tailed) N	0.188 0.191 50	.540** 0.000 50	-

**. Correlation is significant at the 0.01 level (2-tailed).

Technological Comfort: Teachers' Adaptation Through the COVID-19

A Pearson correlation was conducted to examine the relationship between technology integration and teaching comfort among educators before, during, and after the COVID-19 pandemic. The correlations provided insights into the correlation between teachers' comfort levels, frequency of technology use, and proficiency in using technology for online instruction.

Before COVID-19, how comfortable did you feel using technology in your classroom? There is a positive correlation $r(45\text{-}2) = 0.567$, $p < 0.001$ between teachers' comfort levels using

technology before and during the pandemic. This indicates that teachers were comfortable with technology before COVID-19 remained so during the pandemic.

During COVID-19, how comfortable did you feel using technology in your classroom? Similarly, there is a positive correlation $r(45\text{-}2) = 0.520$, $p < 0.001$ between comfort levels during COVID-19 and after it. This suggests that teachers who adapted to using technology during the pandemic continued to feel comfortable incorporating it into their teaching practices afterward.

After COVID-19, how comfortable are you using technology in your classroom? There is a positive correlation $r(45\text{-}2) = 0.678$, $p < 0.001$ between teachers' comfort levels after COVID-19 and their comfort levels during the pandemic. This emphasized the impact of the pandemic on teachers' technological comfort.

Before COVID-19, how often did you integrate technology software applications into your daily instruction? There is a positive correlation $r(45\text{-}2) = 0.218$, $p = 0.150$ between teachers' comfort levels using technology before the pandemic and the frequency of technology integration into their daily instruction. This indicates that teachers who were more comfortable with technology before the pandemic tended to use it more frequently.

After COVID-19, how often are technology software programs incorporated into your daily instruction? There is a non-significant positive correlation $r(45\text{-}2) = 0.006$, $p = 0.969$ between the frequency of incorporating technology into daily instruction after COVID-19 and comfort levels during the pandemic. This suggests that comfort during the pandemic did not strongly predict the post-pandemic frequency of technology use.

Before COVID-19, how proficient were you in using technology to teach students online? There is a significant negative correlation $r(45\text{-}2) = -0.538$, $p < 0.001$ between teachers' proficiency in using technology to teach students online before the pandemic and their comfort levels during the pandemic. This implies that teachers who were more proficient in online teaching technology before the pandemic experienced a decrease in their comfort levels.

In summary, the correlation analysis emphasized how teachers' comfort with technology remained steady throughout the pandemic. The connections found between their comfort levels before COVID-19 and the subsequent phases, as their frequency of integrating technology, highlight the complex relationship between adapting to technology and teaching methods. However, the lack of a correlation between incorporating technology after the pandemic and comfort during it suggests that other factors influence teachers' decisions on integrating technology.

Table 39

Technology Comfortable and Frequency

		1	2	3	4	5	6
1. Before COVID-19, how comfortable did you feel using technology in your classroom?	Pearson Correlation	-					
	Sig. (2-tailed)						
	N						
2. During COVID-19, how comfortable did you feel using technology in your classroom?	Pearson Correlation	.567**	-				
	Sig. (2-tailed)	0.000					
	N	45					
3. After COVID-19, how comfortable are you using technology in your classroom?	Pearson Correlation	.678**	.520**	-			
	Sig. (2-tailed)	0.000	0.000				
	N	45	45				
4. Before COVID-19, how often did you integrate technology software applications into your daily instruction?	Pearson Correlation	0.218	0.147	-0.067	-		
	Sig. (2-tailed)	0.150	0.334	0.663			
	N	45	45	45			
5. After COVID-19, how often are technology software programs incorporated into your daily instruction?	Pearson Correlation	0.006	0.000	0.073	0.054	-	
	Sig. (2-tailed)	0.969	1.000	0.633	0.726		
	N	45	45	45	45		
6. Before COVID-19, how proficient were you in using technology to teach students online?	Pearson Correlation	-0.189	-0.034	0.157	-.538**	0.056	-
	Sig. (2-tailed)	0.213	0.822	0.302	0.000	0.716	
	N	45	45	45	45	45	

**. Correlation is significant at the 0.01 level (2-tailed).

Technology Integration and Teaching Quality

A Pearson correlation was conducted to examine the relationship between integrating various technologies into classroom instruction and the perceived improvement of teaching quality. A positive correlation was found between integrating Chromebooks and laptops for assignments and using smartboards or interactive panels $r(40) = 0.320$, $p = 0.044$. Similarly, integrating smartboards or interactive panels correlated positively with having students use the Internet in lessons $r(40) = 0.507$, $p = 0.001$, indicating a link between technology-enhanced presentations and Internet-based activities.

A significant positive correlation was observed between incorporating Internet use in lessons and the frequency of using Chromebooks and laptops for assignments, as indicated by $r(40) = 0.752$, $p < 0.001$. This relationship underscores the close link between Internet integration in lessons and the use of specific devices for student tasks. Furthermore, a weak positive correlation was noted between having students create Google Slide or PowerPoint presentations and using the Internet as part of lessons $r(39) = 0.276$, $p = 0.089$), highlighting a relationship between multimedia creation and Internet engagement.

An unexpected outcome was observed in the correlation between teachers' perceived improvement of classroom instruction through technology integration and the frequency of technology use $r(40) = -0.244$, $p = 0.130$. This negative correlation suggests that those who reported greater improvements in teaching quality due to technology integration might not necessarily use these technologies more frequently.

In addition, the correlation between multimedia creation, such as Google Slide or PowerPoint presentations, and Internet integration unveiled another dimension of interconnectedness, emphasizing the role of multimedia in enhancing digital engagement.

However, the unanticipated result emerged in the negative correlation between teachers' perceived teaching quality improvement through technology integration and the frequency of technology use. This finding indicates that while some educators may experience qualitative benefits from technology integration, they might not necessarily increase the frequency of its use.

To summarize, the Pearson correlation analysis explored how technology integration in classroom instruction relates to the perceived improvement of teaching quality. The findings are quite interesting as they reveal correlations that suggest connections between technology integration practices. For example, there is a link between using Chromebooks or laptops for assignments and incorporating smartboards or interactive panels, showing synergy between these methods. Similarly, a correlation between using smartboards or interactive panels and implementing Internet-based lessons indicates a relationship between technology presentations and online activities.

Table 40

Technology Integration Practices and Perceived Teaching Quality Enhancement

		1	2	3	4	5
1. How often do you integrate the following technologies into your classroom instruction? - Have students use chrome books, laptops for assignments	Pearson Correlation Sig. (2-tailed) N	-				
2. How often do you integrate the following technologies into your classroom instruction? - Present lessons using a smartboard, interactive panel	Pearson Correlation Sig. (2-tailed) N	.320* 0.044 40	-			
3. How often do you integrate the following technologies into your classroom instruction? - Have students use the Internet as part of their lesson	Pearson Correlation Sig. (2-tailed) N	.752** 0.000 40	.507** 0.001 40	-		
4. How often do you integrate the following technologies into your classroom instruction? - Have students create a Google Slide or PowerPoint presentation	Pearson Correlation Sig. (2-tailed) N	0.183 0.264 39	0.147 0.372 39	0.276 0.089 39	-	
5. I have improved the quality of my classroom instruction by integrating technology.	Pearson Correlation Sig. (2-tailed) N	-0.244 0.130 40	0.089 0.586 40	-0.089 0.586 40	-0.190 0.247 39	-

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

CHAPTER V.

DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS

This chapter outlines the discussions, implications, and recommendations derived from the study's findings. The COVID-19 pandemic drastically impacted the school setting, prompting school districts to embrace digital tools and methodologies. The overarching goal of this chapter is to discuss and interpret the findings from the study. The study stems from the need to understand the implications of the COVID-19 pandemic on both professional development initiatives and digital learning platforms within the Lower South Texas School District. Acknowledging the challenges that educators encountered during this period, the study underscores the potential of professional development tailored for technology integration to elevate instructional methodologies.

The study specifically focused on three research questions:

1. Is there a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic?
2. What is the nature of the relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic?
3. What is the nature of the relationship between time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses?

Discussion

COVID-19's Impact: Tech Evolution in Lower South Texas District

The research hypothesized that there is a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic. For instance, flexible digital tools became indispensable, creating adaptive learning paths for diverse student needs, especially those who were beyond grade-level expectations, ensuring teachers could efficiently address both advanced and struggling learners (Hover & Wise, 2022). For this study, it is important to note that the pandemic's effects were felt predominantly during the last two months of the 2019-2020 academic school year, with the most significant transition to remote learning occurring in the 2020-2021 academic year.

According to the Qualtrics survey, "Learning Online: Technology-Related Professional Development" (Appendix A), platforms such as Nearpod, Microsoft Office 365, and Google Suite were less prevalent before COVID-19. However, with the onset of the pandemic, there was a noticeable pivot in middle school digital tools. These platforms experienced a surge in usage, indicating the district's adaptive response. Still, despite these shifts, Schoology, a favored learning management system, retained its consistency among educators.

The 2019-2020 academic year, the Lower South Texas School District primarily utilized 60 software applications. This number significantly rose in the subsequent academic year, escalating to 247 distinct software applications. By the 2021-2022 academic cycle, this figure increased slightly to 248.

During the 2019-2020 academic year, the district employed various digital tools, with each tool accounting for approximately ten percent of the total technology used in schools. This

balanced distribution of platforms reflected the district's commitment to diverse online learning experiences. However, the unique challenges of the 2020-2021 academic year marked a distinct shift towards Google Meets as the primary tool for virtual instruction during the pandemic's height.

The 2021-2022 academic year witnessed further advancements in integrating digital tools. As schools iteratively refined teaching methodologies, a more comprehensive array of platforms found acceptance. While established systems like Google Classroom stayed at the forefront, newer platforms like Imagine Edgenuity/MyPath and Lexia PowerUp gained traction. This diversification epitomizes the district's dedication to improving instruction and addressing diverse student learning needs.

In conclusion, the findings of this study corroborated the initial hypothesis, highlighting that there was indeed a significant difference in the frequency of use of digital platforms among middle schools in the Lower South Texas School District during the COVID-19 pandemic. The adaptability and resilience displayed by these middle schools throughout the pandemic are commendable. The progression from initial tools like Nearpod to the later adoption of platforms like Imagine Edgenuity underscores the overarching narrative of educational innovation. Moreover, it emphasizes the pivotal role of technology in navigating unprecedented educational challenges.

Professional Development Workshops and Nearpod Lesson Implementation

The second hypothesis for this research was that there was a significant relationship between teachers' professional development attendance and Nearpod lesson integration during the pandemic. For effective integration of tools like Nearpod, it's imperative that professional development immerses teachers in inquiry, experimentation, and practical applications (Van As,

2017). Additionally, setting clear outcomes for such professional development programs ensures that educators are primed for effective use of these tools (Lawless & Pellegrino, 2016). Each campus's distinctive characteristics were examined to address this, including the prevalence of digital platform use, Nearpod workshop attendance, and the time teachers devoted to these workshops. These factors provided a clearer picture of how educators adapted during the pandemic era.

Nearpod was selected as the digital platform for the second research question among the various digital platforms. In the 2019-2020 academic school year, Nearpod had been embraced by 2% of the teachers. However, a significant shift was witnessed in the 2020-2021 academic year, with 55.2% of educators integrating Nearpod into their curriculum. Unfortunately, by the 2021-2022 academic year, this percentage reduced to 35.7%. Such variations might have resulted from teachers needing to familiarize themselves with Nearpod or undergo adequate training. The substantial rise in the subsequent year suggests heightened awareness or an intensified emphasis on Nearpod-centric professional development.

Data revealed that gender played a role in determining the outcomes for this specific research question. Female teachers were more inclined to attend Nearpod-focused workshops and invested more time in its training than their male counterparts. This trend emphasized the hypothesis, suggesting a relation between professional development participation and the adoption of Nearpod in teaching methods, particularly among female educators.

The narrative remained relatively unchanged when broken down according to grade level. No distinct differences were found in the attendance at Nearpod workshops, or the hours spent on training among 6th, 7th, or 8th-grade teachers. Therefore, grade level did not determine a role in shaping teachers' professional development decisions.

In conclusion, the relationship between Nearpod's integration in the past and engagement in professional development has been noticeable, especially among female teachers. This connection emphasizes the importance of growth in today's ever-changing educational landscape.

Principals' Professional Development & Campus Digital Use

The third hypothesis of this study was there is a significant relationship between the time invested by campus principals in technology-related professional development and teachers' adoption of digital platforms during the pandemic at the principals' campuses. Digital literacy, going beyond just the ability to use a tool, empowers participation in broader educational networks, fostering knowledge sharing and supporting a wide range of professional computing skills (Chetty et al., 2018). Furthermore, diverse modalities in teacher training, especially during such unprecedented times, are essential to manage and motivate learning effectively in virtual environments (Ramirez-Montoya et al., 2021). The data revealed that out of the principal group, six female and four male principals indicated the proportion of principals during the COVID-19 era. Male principals had a higher student enrollment and supervised more teachers, on average, compared to their female counterparts.

Looking at technology professional development among principals, it was found that female principals attended fewer technology-related workshops and dedicated less time to technology-related activities compared to male principals. However, there was a correlation between attending technology-related workshops and spending time on technology-related activities for both principals and campuses, especially in the 2020-2021 academic year.

Regarding platforms during the pandemic, there were differences in the number of software applications utilized by campuses over three consecutive academic years (2019-2020, 2020-2021, and 2021-2022). Google Meets was the application in the academic year 2020-2021,

while Google Classroom, Imagine Edgenuity / MyPath, Lexia PowerUp, and Schoology gained popularity in the following year, 2021 2022.

Moreover, a Pearson correlation analysis explored the connections between variables. The analysis revealed correlations that provide valuable insights into these relationships. Notably a correlation between principals' age and overall experience within the school district. As principals grow older, their experience within the district tends to increase.

Additionally, correlations between principals and schools that attended technology-related workshops and the amount of time they dedicated to technology-related activities were discovered. This highlights the importance of development for principals and its impact on technological integration in schools, particularly during challenging times like a pandemic.

Furthermore, the study identified an association between student enrollment numbers and the total number of digital applications utilized by schools during academic years. Larger student populations were linked to increased utilization of platforms, emphasizing how crucial these platforms are in meeting student needs.

In light of the findings presented it became evident that a principal's engagement in technology-focused professional development played a role in determining how their campus integrated digital platforms, especially during periods like the pandemic. The active involvement of principals in technological workshops and activities encouraged them and influenced their teaching staff to utilize better and integrate technological tools. The data also underscored the adaptability of schools with larger enrollments in employing diverse digital platforms to meet their student needs. For instance, as observed in the wider educational landscape, platforms offering microlearning modules — concise, topic-focused content — have become more popular

as they address specific learning needs and are adaptable for various educational contexts (Chisega-Negrila, 2022). Therefore, the essence of the research culminated in the understanding that equipping principals with relevant professional development was paramount to fostering an environment that leveraged technology optimally, particularly when faced with unprecedented educational challenges.

Implications

This research examines the relationship between technologies and professional development within education during COVID-19, focusing on middle schools in the Lower South Texas School District. A significant finding from the study is the increased adoption of platforms like Nearpod, Microsoft Office 365, and Google Suite throughout the pandemic's duration. However, there appears to be a noticeable gap in comprehending the intrinsic value of these technologies and an evident shortage of communities advocating digital literacy in the Lower South Texas School District.

It is paramount, however, to approach these conclusions with an awareness of the study's limitations. These encompass the study's geographical focus, reliance on self-reported data, the unique challenges introduced by the pandemic, and potential oversights like available resources and school cultural characteristics that could influence digital platform adoption.

The research highlighted certain demographic variables, such as age and gender, that played roles in determining participation levels in technological development endeavors. An exciting discovery was the evolving pattern of Nearpod usage, highlighting the need for a more in-depth exploration of the determinants of prolonged technological tool adoption.

Additionally, this study revealed ties between school principals' characteristics, their professional development, and the resulting digital platform usage in their respective schools. A case in point: male principals demonstrated a higher tendency towards technology-related focused workshops, a trend that led to heightened digital platform usage within their school. Furthermore, schools with larger student populations appeared to be more active users of these platforms, underlining their role in adapting to diverse student needs.

In wrapping up, this research emphasized the pronounced influence of professional development in seamlessly incorporating digital tools into the educational setting, more so during times similar to the COVID-19 pandemic. However, framing these insights against the study's context and limitations is vital. The outcomes highlight the imperative for thoughtfully prepared technology-oriented professional development initiatives for educational decision-makers. There is also a pressing need to determine platform usage trends and to actively engage school leaders in spearheading the technology initiatives at their campuses.

Recommendations

This study researched how professional development workshops impacted the technology proficiency of teachers and principals. This study presented a set of recommendations drawn from the findings aiming to enhance the integration of technology in schools. By recognizing the significance of customized professional development opportunities, addressing gender disparities, and fostering inclusive technology platforms, school districts and policymakers can equip teachers with the necessary skills to navigate the digital landscape successfully and elevate the quality of teaching and learning experiences in the ever-evolving educational landscape. This will ultimately elevate the quality of teaching and learning experiences in a changing landscape.

1. Enhance Professional Development Opportunities: School districts should invest in targeted professional development workshops and training programs on technology integration. These programs should be tailored to the specific needs of teachers and principals, providing them with the necessary skills and knowledge to use digital tools in their classrooms effectively. High-quality training should deeply engage educators, prompting them to actively explore and question. This approach serves as a template for how they should approach technology in their classrooms. (Van As, 2017)
2. Sustain Technology Adoption: Viewing professional development as a process rather than a one-time occurrence is essential to ensure that technology adoption remains consistent. For professional development to be effective, its goals should be clearly stated, and there should be strategies in place to evaluate its outcomes. This ensures that technology integration remains a continuous journey rather than a one-off event. (Lawless & Pellegrino, 2016) This means providing educators with support and training throughout their tenure. School districts and policymakers should develop long-term plans for professional development about technology. This will help facilitate technology integration during challenging times like the past pandemic.
3. Principal Leadership in Technology Integration: School districts could prioritize the development of principals in the realm of technology. Diverse training modalities help administrators explore novel ways to oversee, evaluate, and boost learning in online settings, promoting a tech-forward approach in schools. (Ramirez-Montoya et al., 2021). When principals understand technology, they are

better equipped to support and encourage technological integration in their schools. This, in turn, leads to an adoption rate of platforms.

4. Foster Inclusive Technology Platforms: School districts should select technology platforms that respond to the diverse needs of students and teachers. Platforms that offer versatility and accessibility can better support effective teaching and learning across various subject areas and student populations. Adaptable digital resources are crucial for curating custom learning journeys, especially for students at varying academic levels. This ensures that educators have the tools they need to address both advanced learners and those who might be struggling. (Hover & Wise, 2022)
5. Promote Digital Literacy: To address digital literacy gaps, school districts could offer resources and support to educators who may need to become more familiar with the technology. Being digitally literate goes beyond basic tool usage. It is about participating in educational communities, sharing knowledge, and honing a wide array of tech-driven professional competencies (Chetty et al., 2018). This can involve workshops, tutorials, and mentoring programs that enhance educators' technological skills and confidence.
6. Monitor Technology Usage Patterns: Districts should regularly monitor and evaluate technology usage patterns to understand changes in adoption rates over time. This monitoring can help identify potential challenges and opportunities for improvement in technology integration.
7. Continuation of Research: The study should be continued beyond the scope of the COVID-19 pandemic to explore the long-term impact of technology-related

professional development on teaching practices and student outcomes. Further research will offer insights into the lasting advantages of development and help shape future policy decisions.

Summary

This extensive research investigated the influence of professional development on technology integration in education. It focused on schools in the Lower South Texas school district during the COVID-19 pandemic. The study identified a relationship between teachers' attendance at professional development workshops and their integration of Nearpod lessons. Notably, Nearpod adoption rates varied dramatically over three academic years, peaking in 2020-2021 at 55.2% and then declining to 35.7% in 2021-2022. Female teachers exhibited a stronger inclination to attend Nearpod-focused workshops than their male counterparts, with grade level not influencing attendance or time spent on such workshops.

In terms of leadership, there is a correlation between principals' technological professional development and the adoption of digital platforms by teachers. Male principals, who oversaw more students and faculty, displayed a higher tendency towards technology-related workshops than female principals. There were observed shifts in the popularity of platforms like Google Meets, Google Classroom, Imagine Edgenuity/MyPath, Lexia PowerUp, and Schoology across three academic years. The study also uncovered a relationship between principal age and experience within the district. It also uncovered a correlation between their engagement in tech workshops and digital activity on their campuses. Schools with larger student populations demonstrated more varied digital platform usage.

Despite the increased adoption of platforms like Nearpod, Microsoft Office 365, and Google Suite during the pandemic, there was a discernible gap in understanding these technologies' intrinsic value. There was also a shortage of advocates for digital literacy in the district. The study highlighted demographic factors such as age and gender as influencers on technological development. Overall, professional development was found to play a pivotal role in incorporating digital tools in educational settings, especially during the COVID-19 pandemic challenges.

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APPENDIX A

APPENDIX A

Section 1: Opinions and Attitudes of Professional Development

1. Overall, I feel that I am growing professionally as a result of the professional development opportunities offered in my district.
    a. Strongly agree
    b. Somewhat agree
    c. Neither agree nor disagree
    d. Somewhat disagree
    e. Strongly disagree
2. My profession allows me to learn and develop new skills to enhance classroom instruction.
    a. Strongly agree
    b. Somewhat agree
    c. Neither agree nor disagree
    d. Somewhat disagree
    e. Strongly disagree
3. The online professional development offered **before** COVID-19 prepared me to teach students remotely?
    a. Strongly agree
    b. Somewhat agree

c. Neither agree nor disagree

d. Somewhat disagree

e. Strongly disagree

4. The online professional development offered **during** COVID-19 prepared me to teach students remotely?

    a. Strongly agree

    b. Somewhat agree

    c. Neither agree nor disagree

    d. Somewhat disagree

    e. Strongly disagree

5. The online professional development offered **after** COVID-19 prepared me to teach students remotely?

    a. Strongly agree

    b. Somewhat agree

    c. Neither agree nor disagree

    d. Somewhat disagree

    e. Strongly disagree

6. How prepared were you to remotely teach your assignment **before** school closure due to COVID-19?

    a. Not prepared at all

    b. Slightly prepared

    c. Moderately prepared

    d. Very prepared

e. Extremely prepared

7. Do you feel prepared to teach remotely **after** COVID-19 if your assignment requires it?
    a. Not prepared at all
    b. Slightly prepared
    c. Moderately prepared
    d. Very prepared
    e. Extremely prepared

Section 2: Using Technology to Deliver Instruction Remotely to Students

8. **Before** COVID-19, how comfortable did you feel using technology in your classroom?
    a. Extremely comfortable
    b. Somewhat comfortable
    c. Neither comfortable nor uncomfortable
    d. Somewhat uncomfortable
    e. Extremely uncomfortable

9. **During** COVID-19, how comfortable did you feel using technology in your classroom?
    a. Extremely comfortable
    b. Somewhat comfortable
    c. Neither comfortable nor uncomfortable
    d. Somewhat uncomfortable

e. Extremely uncomfortable

10. **After** COVID-19, how comfortable are you using technology in your classroom?
    a. Extremely comfortable
    b. Somewhat comfortable
    c. Neither comfortable nor uncomfortable
    d. Somewhat uncomfortable
    e. Extremely uncomfortable

11. **Before** COVID-19, how often did you integrate technology software applications into your daily instruction?
    a. Always
    b. Most of the time
    c. About half the time
    d. Sometimes
    e. Never

12. **After** COVID-19, how often are technology software programs incorporated into your daily instruction?
    a. Always
    b. Most of the time
    c. About half the time
    d. Sometimes
    e. Never

13. **Before** COVID-19, how proficient were you in using technology to teach students online?
    a. Not proficient at all
    b. Slightly proficient
    c. Moderately proficient
    d. Very proficient
    e. Extremely proficient

14. **After** COVID-19, how proficient are you in using technology to teach students online?
    a. Not proficient at all
    b. Slightly proficient
    c. Moderately proficient
    d. Very proficient
    e. Extremely proficient

15. What online teaching tools were you familiar with **before** COVID-19? Choose all the options that apply.
    a. Google Classroom
    b. Microsoft Teams
    c. Nearpod
    d. Schoology
    e. Zoom
    f. Other, please specify

16. What online tools did you use for educational assessment in the classroom **during** COVID-19? Choose all that apply.
    a. Google Classroom
    b. Microsoft Teams
    c. Nearpod
    d. Schoology
    e. Zoom
    f. Other, please specify
17. **After** receiving professional development, what online communication tools did you use during the COVID-19 pandemic with your students? Choose all the options that apply.
    a. Google Meets
    b. Microsoft Teams
    c. Schoology
    d. Zoom
    e. Other, please specify
18. What tools did you use for educational assessment in the classroom **before** COVID-19? Choose all that apply.
    a. Google Suite
    b. Microsoft Office 365
    c. Nearpod
    d. Schoology
    e. None

f. Other, please specify

19. What tools do you use for educational assessment in the classroom **after** COVID-19? Choose all that apply.

a. Google Suite

b. Microsoft Office 365

c. Nearpod

d. Schoology

e. None

f. Other, please specify

Section 3: TPACK Model Integration

20. How often do you integrate the following technologies into your classroom instruction?					
	Never	Sometimes	About half the time	Most of the Time	Always
Have students use chrome books and laptops for assignments					
Present lessons using a smartboard, interactive panel					
Have students use the Internet as part of their lesson					
Have students create a Google Slide or PowerPoint presentation					

21. I have improved the quality of my classroom instruction by integrating technology.
    a. Strongly agree
    b. Somewhat agree
    c. Neither agree nor disagree
    d. Somewhat disagree
    e. Strongly disagree
22. In what ways do you integrate technology into your daily lesson plans and instruction?
23. Could you give an example of a recent lesson in which technology played an important role in student learning?
24. When integrating technology into the classroom, how do you assess students' learning and understanding?

Section 4: The Importance of a Digital Leader

25. What impact does technology training provided by your principal have on your use of technology in the classroom?
    a. A great deal
    b. A lot
    c. A moderate amount
    d. A little
    e. None at all
26. I am more likely to use technology in the classroom if my principal expects it.
    a. Strongly agree

b. Somewhat agree

c. Neither agree nor disagree

d. Somewhat disagree

e. Strongly disagree

27. It is essential for my principal to understand how to integrate technology into the classroom.

a. Strongly agree

b. Somewhat agree

c. Neither agree nor disagree

d. Somewhat disagree

e. Strongly disagree

28. My principal should provide time and support for technology training.

a. Strongly agree

b. Somewhat agree

c. Neither agree nor disagree

d. Somewhat disagree

e. Strongly disagree

Section 5: Teacher Demographics

29. What is the grade level of your current teaching assignment?

a. 6th

b. 7th

c. 8th

d. Combination of grades

30. What is your current age?

31. What gender identity do you identify with the most?

a. Male

b. Female

c. Non-binary/third gender

d. Pre not to say

32. Which best describes your ethnicity?

a. White

b. Black or African American

c. American Indian or Alaska Native

d. Asian

e. Native Hawaiian or Pacific Islander

f. Other

33. What is the highest level of education you have completed?

a. Some college

b. 2-year degree

c. 4-year degree

d. Master's degree

e. Doctorate

34. As an undergraduate, did you major in current teaching assignment?

a. Yes

b. No

35. Please list any certificates that you have obtained in your career.
36. How many years of teaching experience will you have by the end of this school year?

BIOGRAPHICAL SKETCH

For the past two decades, Cynthia Castro, originally from Brownsville, Texas, dedicated her time actively to the field of education. Before her educational endeavors, she honorably served in the United States Air Force, marking her dedication to education and her country.

Cynthia pursued her academic ambitions, earning a bachelor's degree in psychology from Wesley College. She continued her education with a master's degree in educational administration from the University of Phoenix and later achieved a superintendent certificate from the University of Texas at Tyler.

Over the years, Cynthia held various roles in public education. She served as a special education teacher at Stell Middle School before advancing to the position of dean of instruction at Veterans Memorial High School and Stell Middle School. Her leadership skills shone brightly as she took on the principal role at Oliveira Middle School. Currently, she is currently the Director of Professional Development.

In her quest for continuous knowledge, Cynthia embarked on her doctoral studies at the University of Texas – Rio Grande Valley, culminating in her achieving her degree in December 2023.

Cynthia Castro currently resides in Brownsville, Texas, with her loving family: her husband and their two children. For further inquiries or to reach out, she is available at cindysc32@gmail.com.