

**Urban Middle and High School Math Teachers' Perceptions and Strategies of
Adaptive Learning Technology Math Tool Integration Practices**

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Chapter 1: Introduction

Introduction

A strong foundation in math skills is essential for many aspects of life. “Math education comprises a set of fundamental skills vital to success in modern culture” (Smith, 2021).

However, grasping math concepts remains a big obstacle for many students. “Many students continue to struggle with understanding mathematical concepts, and transferable skills can be challenging” (Archer, 2024). Therefore, a solid foundation to understand core concepts in math is crucial to post-secondary success, so schools must invest in providing excellent math education for all students. “In light of the relationship between mathematics proficiency and postsecondary success, schools need to focus on providing high-quality math instruction for students” (Higa, 2017).

Research reveals that “Technology could spark students’ intellectual curiosity and give them a window to resources and skills beyond the classroom”(Rebora, 2016). Also, technology can make teachers more efficient and impactful when setting “A clear purpose for technology integration to maximize teacher’s ability and student results” Morse (2019). Therefore, research shows that Various math technology tools benefit teachers and students. Another research proves the first one: “The use of virtual manipulatives allows for instant feedback, opportunities for self-regulation, and increased instructional time” (Higa, 2017). The same source found that “Virtual objects can also be manipulated in more ways than physical manipulatives, providing opportunities for increased conceptual understanding” (Higa, 2017). Despite research supporting technology-based interventions for a better result, research mentioned that “The use of instructional technology in the classroom is not widespread” Morse (2019)

Statement of The Problem

Popa & Biclea (2023) reported that mathematics is a key subject for building future competencies. Therefore, math teachers must be fully aware of how to use adaptive learning technology tools in their classes. Teemer-Hill (2016) recommended that teachers must be properly trained to ensure seamless and successful integration of math tools into the mathematics classroom. The same source noted that students could develop a deeper conceptual understanding of mathematics concepts, thus allowing them to explore more rigorous concepts, possibly leading to advanced mathematics courses. One study reported that “Students and teachers have the full spectrum of materials within reach.” Morse (2019) To obtain this result, researchers emphasized the importance of ensuring that “All teachers understand and are capable of fully integrating technology into the classroom.” Morse (2019). In this study project, the researcher wants to investigate further the role that middle and high school teachers’ perceptions of math educational technology tools play in determining the integration of adaptive learning technology tools in their classrooms because researches show that “ The progress of digitally driven instructional change has been slow in many schools” Rebora (2016)

The following review will discuss the literature related to technology integration in middle and secondary math classrooms. The research paper aims to explore middle and high school math teachers’ opinions and best practices for utilizing adaptive learning math tech tools in their classes. “To prepare students with skills to compete in a digital economy requires technological literacy, but many teachers are not prepared” (Smith, 2021). This topic was carefully chosen for its importance in the field of education. Kumor (2021) reveals a gap in the research on adaptive learning tools. However, integrating technology and math tools cannot be separated from pedagogy and content area; rather, they interact. Higa (2017) explained that

effective integration of technology, pedagogy, and content requires an understanding of how each area of knowledge interacts with and influences other areas. Tassell et al. (2019) argued that teachers need advanced instructional skills in mathematics and technology. There has been significant evidence connecting effective teaching strategies and student learning. However, there has been limited research on how teachers use adaptive learning tools. “Few studies have attempted to research how educators have implemented teaching strategies while using adaptive learning systems” (Kumor, 2021).

Purpose of the Study

In qualitative research, Creswell & Creswell (2018) explained that “Good qualitative purpose statements contain information about the central phenomenon explored in the study, the participants in the study, and the research site” (118). The purpose of this qualitative research is to understand the perception of math teachers at both middle and high school levels and the role and mission of adaptive learning technology integration in their classrooms. The study explores the influence of core content area teachers on math tech tools integration as perceived by middle and high school math teachers. Despite the importance of determining the perception of math teachers regarding math technology integration in middle and high schools, little research has been done in that area.

Research reveals that when students experience success through tech-based learning, they can develop a positive self-image as capable learners, making them more likely to develop critical thinking abilities and problem-solving skills in related jobs. Therefore, math teachers must be aware of the importance of integrating educational tools and utilizing them in their classrooms to help students have a positive attitude and become better learners. Ibili et al. (2019)

argued that positive attitudes in math boost math performance, minimize math avoidance, and motivate students to pursue math-related careers. Tassell et al. (2019) stated that new teachers often do not have time to keep abreast of the latest research in strategies and technology integration. Therefore, assessing the middle and high school math teachers' perceptions helps guide what they think technology integration is and how to move toward effective technology integration. Tassell et al.(2019) recommended that when teachers are helped by giving them more opportunities for growth in self-efficacy, outcome expectancy improves. In this regard, Dirksen (2016) defined self-efficiency as someone's belief in their ability to succeed.

Significance of the Study

As a high school math teacher, I am intrigued to do my qualitative research study to find out how other teachers in the field effectively apply adaptive technology tools in the instructional setting. Kumor (2021) discusses the importance of focusing on qualitative studies to capture the voices of actual mathematics teachers through a research study. I am also interested in finding ways to meet teachers' needs, so they will not only understand how to integrate math tech tools into math instruction more effectively but also be motivated to use them for math instruction. "Adding a digital device to the classroom without a fundamental change in the culture of teaching and learning will not lead to significant improvement." Morse (2019)

It is important to understand the specific needs of middle and high school math teachers for math instructional applications and the best way to assist them in adopting the available math technology. "Inform policymakers, school administrators in secondary education, and college professors in pre-service education and school leadership programs on factors that promote successful teacher use of technology" Esposito (2013), Furthermore, Bruton (2018) reported that

teachers need more training in combining their content and technology knowledge to choose technical applications that enhance their content and allow for effective technology integration. Ibili et al. (2019) argued that the satisfaction and attitude of teachers would also be indirectly affected by factors of perceived usefulness.

Hence, this study will try to fill gaps in the research by providing evidence of teachers' perceptions of various math adaptive learning tech tools. Most studies have attempted to measure student success based on improvements in test scores but have failed to provide any information regarding the teachers' opinions while implementing these tools. Kumor (2021) suggested that "The results of this study provide school administrators with accounts of the experiences and perceptions of teachers so that they can plan effective training and support for teachers."

Research Questions

The following qualitative questions will be used to guide this research study:

Question # 1: What are middle and high school math teachers' perceptions of adaptive learning technology integration in an urban school's instructional setting?

Question # 2: How are math teachers incorporating adaptive learning math technology tools into middle and secondary classrooms to support math instruction for students in urban areas?

Question # 3: How do middle and high school math teachers in urban areas describe the relationship between their school's mission and technology integration?

Definitions

In this study, the following items are included:

Adaptive learning technology: “Adaptive learning technology is an electronic means to implement personalized learning” (Holt, 2019)

Technology integration: “Technology integration is a very broad spectrum. There are major areas for technology integration in the classroom, including hardware (tablets, computers, smartphones), educational programs (Khan Academy, PhET Interactive, Jason.org), management programs, and social media” Morse (2019)

Digital citizenship: “Digital citizenship is one of the national technology standards that explains and emphasizes the importance of properly using technology in a technology-driven world” (Smith, 2021)

Teaching Strategy: the term teaching strategy is defined as“ the structure, system, methods, techniques, procedures, and processes that a teacher uses during instruction“ (Northwest Missouri State University, 2019 & Hamilton, 2019)

Facilitator: “Facilitator: Educators who facilitate learning with technology to support student achievement of the ISTE Standards for Students” (ISTE, 2017f & Riegel, C. (2018).

Instructional Technology: “Instructional technology is the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning” (LSU, 2020 & Finnegan, 2021)

ATLAS.ti: ATLAS.ti is a Mac and Windows program that enables the researcher to organize text, graphic, audio, and visual data files, along with coding, memos, and findings, into a project. (Creswell and Gutterman ,2019)

Limitations

The participants will be from middle and high schools in urban areas, and thus, they will not reflect any potential degree associated with teaching in private or rural areas. Generalizing the results to other grade levels and subject areas is limited. Future research should focus on a larger participant pool within a single district to understand the overall perception of faculty and build a focused plan addressing district needs. ”Morse (2019) The researcher will work with just one district in the state of New Jersey, and the results are not generalizable. A broader sample will be needed to verify these results. In addition, teachers in this study will be selected based on snowball sampling. “ Snowball sampling is a non-probability sampling method used in qualitative and social science research to gather data from hard-to-reach or specialized populations. It begins with a small sample group of known research participants who fit the study's criteria and then expands by asking those initial participants to recommend others who also qualify” (Stewart, 2024)

Another limitation involves not using mixed methods, where qualitative and quantitative methods are to be used. Teachers with more years of experience and teachers just out of college will take similar qualitative surveys, which may lead the survey questions to be purposefully vague because each participant would have either a great or limited experience with that particular subject matter. The researcher does not have experience with every technology tool the participants utilize in the middle school classroom because the participant is a high school math teacher who works in an urban area. Creswell and Gutterman (2019) argued that “Limitations are useful to other potential researchers who may choose to conduct a similar or replication study. Advancing these limitations provides a useful bridge for recommending future studies” (p.200). “Future studies use a larger sample size, collect longitudinal data, and focus on individual

student attitudes and behaviors. The collection of additional data is also recommended, including quantitative practice data and student survey data” (Higa, 2017)

Delimitations

The participants will be purposely selected to represent different levels of technology integration and each grade level of middle and high school to avoid limitations. To overcome some of the limitations, research announces that “Teachers are currently considered facilitators in the classroom, meaning they are no longer the sole provider of learning and knowledge because of the easily accessible digital information” (Smith, 2021). Also, Tassell et al. (2019) stated that “The field of mathematics education is continuously evolving with the integration of technology.” Bourassa (2021) explained that “Sites give teachers resources to help students reason about mathematics and communicate their thinking.”

Assumptions

The researcher will assume that math teachers in middle and high schools in urban areas, namely Hudson County, New Jersey, will be comfortable sharing their thoughts honestly and truthfully with the researcher. Since the participants will be math teachers at the middle to high school level, they understand the nature of this research study and the importance of providing accurate information. So, they will be honest and forthcoming when sharing the details about their best practices and perceptions of math technology tools in their classrooms. The procedures to maintain teachers’ confidentiality and anonymity will be described to participants before the interviews occur. Thus, the research believes that math teachers in middle and high school will feel comfortable sharing their experiences and understanding regardless of whether those experiences and understanding are positive or negative. This study also assumed that teachers

were honest and forthright about their experiences as educators using various adaptive learning tools regularly.

Summary

“The shift going on in education is due to the consistent growth of technology.” Morse (2019) Despite research having revealed that “In domestic and international education, technology provides the same information to all students” Morse (2019). Still, it is not as effectively integrated as it should be “Educators must be aware of the various types of interventions that exist in education with specific regard to mathematics. They need to understand the differences between each intervention and whether they have proven successful.” (Karner, 2016)

Chapter 2: Literature Review

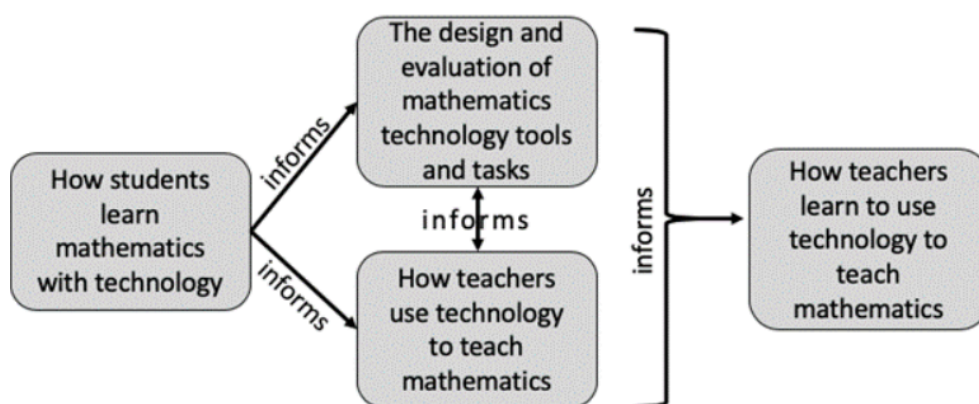
Introduction

“Literature review is conducted in order to gain an understanding of the topics and concepts related to the components of this study.” (Creswell and Gutterman, 2019) “While the advances in technology offered much promise, there was never a significant shift in the dynamics of the classroom...The teacher is still the central figure surrounded by recipients, the students. .” Morse (2019). The same source also stated that “While money is spent in districts across the country to acquire technology for the instructional setting, meeting these criteria is one reason technology hasn’t been utilized as effectively.”. Kopcha et al. (2020) argue that current perspectives about technology integration do not match the realities of using technology in today’s classrooms. The review of the literature helps shape the focal points of the study and

creates the baseline for the data analysis. Morse (2019) “Educating faculty with digital tools for improving student learning and teaching methods may help each school to create an environment of continuous improvement and student achievement” (Stephan, 2017)

Theoretical Framework

Patton (2015) argued that qualitative inquiry frameworks should “Focus on and distinguish core inquiry questions as the basis for understanding and contracting long-standing and emergent qualitative inquiry approaches.” Karam et al.(2017) argued that the framework needs to encompass Three major elements to examine the implementation of programs: (1) fidelity, (2) dosage or frequency, and (3) program differentiation. Fidelity of implementation can be critical in determining whether a program truly has the impact it was designed to achieve. Without examining fidelity, the connection between the program and its outcomes cannot be made. It is also important to examine the dosage or frequency of implementation, irrespective of fidelity. Educators might deviate... This adaptation may lead to improved outcomes. Finally, program differentiation or identifying which program components make a difference.



McCulloch, A., Leatham, K., Bailey, N., Cayton, C., Fye, K., & Lovett, J. (2021). Theoretically framing the pedagogy of learning to teach mathematics with technology.

Contemporary Issues in Technology and Teacher Education, 21(2).

<https://citejournal.org/volume-21/issue-2-21/mathematics/theoretically-framing-the-pedagogy-of-learning-to-teach-mathematics-with-technology>

The theoretical framework for this study is based on a constructivist ideology. “It is through actions and experience that we construct our reality and perception. Dewey, Piaget, Vygotsky, and even Socrates are considered founders of constructivist theory in education. Their beliefs and philosophies are centered on building, learning, and doing. Integrating technology in the classroom coincides with this theory.” Morse (2019). Moreover, Tassell et al. (2019) explained that increased student learning or mathematics scores result from effective teacher instruction. The ISTE Standards ensure that using technology for learning creates high-impact, sustainable, scalable, and equitable learning experiences for all learners.



Source for NETS*T standards: International Society for Technology in Education (ISTE). (2008). *ISTE National Educational Technology Standards for Teachers (NETS*T)*. In ISTE. Retrieved December 2, 2013, from <http://www.iste.org/docs/pdfs/nets-t-standards.pdf?sfvrsn=2>

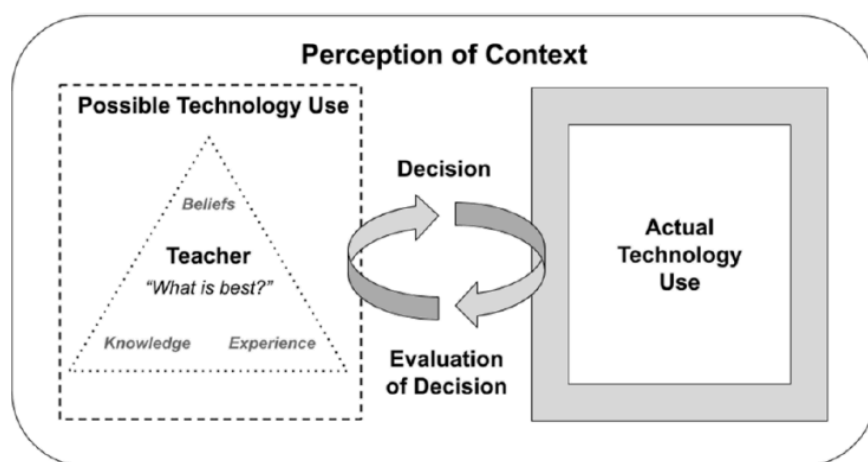
Related Literature

The research seeks an understanding of perceptions, attitudes, and beliefs that require teachers to have the most effective training and practices for using technology in the classroom. Ibili et al. (2019) argued that the satisfaction and attitude of teachers would also be indirectly affected by factors of perceived usefulness. Teachers must be familiar with using different math applications to benefit their students. “Students had limited knowledge and ability to use technology appropriately for instructional purposes.” Morse (2019). However, Karam et al. (2017) state that teachers should act as facilitators rather than a lecturers. As such, teachers should devote a minimal amount of time to reviewing, presenting, or demonstrating procedures to the whole class. To facilitate student learning, teachers ask deep probing questions that encourage students to expand and clarify their thinking using ed tech tools.

While research continues to grow, the current studies still show a small sample of teacher perception in the area of math technology integration into the urban middle school classroom. The present study investigates the urban math teachers’ perception regarding effective technology implementation in the instructional setting. A number of teachers do not have the “Ability to use and integrate technology into their instructional and professional environment.” “The results of numerous research studies suggest benefits but also show problems with technology integration. Test scores are inconclusive in determining how effective technology use in the instructional setting” Morse (2019)

“The key to moving forward is technology integration into the instructional setting. Technology integration is a very broad spectrum. There are major areas for technology integration in the classroom, including hardware (tablets, computers, smartphones), educational programs (Khan Academy, PhET Interactive, Jason.org), management programs, and social media.” Morse (2019). Weng et al. (2024) identified research trends and evidence-based

practices on teaching aids to enhance remedial mathematics instruction. “Instruction involving virtual manipulatives has improved student math outcomes.”(Higa, 2017). Kopcha et al. (2020) suggest how a teacher decides to use technology. Specifically, they suggest that technology integration presents a model of teacher decision-making about technology that combines the three key ideas: value-driven, embedded in a dynamic system, and a product of a teacher’s perception of what is possible. “The model called the Teacher Response Model (TRM) of Technology Integration visually represents a teacher’s decision to use technology as it takes place within a dynamic system.”



The study will determine how middle and high school math teachers feel technology is effectively integrated into an instructional setting. “These have been used to improve computation fluency, conceptual knowledge, and math application skills” (Higa, 2017)

Summary

Some reasons for teachers’ attitudes or perceptions of teaching using adaptive technology are related to essential factors. Ibili et al. (2019) stated that math teachers' educational technology tools depend on three variables: (1) expectation approval, (2) satisfaction, and (3) perceived

usefulness. Some of these factors may be out of the control of math teachers, such as insufficient training for the tool in their classes with their students. “31 percent of educators say they’re not able to use technology because of a lack of training, and 63 percent of teachers said district communication about the educational technology available for classroom use is moderate or non-existent.” (Davis, 2019). “One of the first and most vital parts of technology integration is determining the type and amount of technology being integrated into an instructional setting. Understanding what technology integration is in the instructional setting allows for a better understanding of the guidelines for technology integration. When discussing educational technology, it will refer to technology students use to interact in the instructional setting. The decision on the specific educational technology will set the boundaries for applications and student interactions.”Morse (2019)

Chapter 3: Methodology

Introduction

This research is designed to provide an in-depth analysis of the teachers’ perceptions of technology integration based on their experiences. The researcher will use one-on-one interviews, and then focus group interviews will follow to evaluate how teachers understand the various math tech tools to explore the different applications used and how those teachers perceived them. The resulting outcome may improve technology integration in middle and high school math classes. One of the characteristics that Creswell & Creswell (2018) explained of qualitative methods is that “Participants share their ideas freely, not constrained by predetermined scales or instruments” (p.181)

Purposive sampling is used to identify middle and high school math teachers recruited based on their current math certification and position within an urban middle or high school in New Jersey. Tassell et al. (2019) argued that if teachers are provided appropriate professional development about mathematics and technology integration, with chances to practice, discuss, and reflect on experiences, their beliefs in their abilities to increase student learning in mathematics also have growth potential. Popa & Biclea (2023) To continuously improve the quality of mathematics teaching, educators and researchers are increasingly turning to innovative technologies as valuable allies in the learning process, especially when working with children. “One of the gaps in the literature on adaptive learning tools in mathematics classrooms is the absence of user voices, a problem which requires qualitative research.”

Research Design

This study followed a basic qualitative design in its methodology. This study will follow a qualitative design approach for its methodology. Creswell & Creswell (2018) described a qualitative study where “The process of research involves emerging questions and procedures, data typically collected in the participants’ setting” (p. 4). I would start by creating a qualitative survey instrument. However, Creswell and Gutterman (2019) declared that designing good survey instruments is challenging and complex. Therefore, I will design my instrument and perform a pilot test of the questions. “This consists of administering the instrument to a small number of individuals and making changes based on their feedback.” (Creswell & Gutterman, 2019, p.394) Patton (2015) noted that the research needs to be clear about the purpose of the intended research. The same source also explained that “Phenomenology aims at gaining a deeper understanding of the nature or meaning of our everyday experiences.” Only middle and high school math teachers will be included in the research design. “Phenomenological research is

a design that culminates in the essence of the experience for several individuals who have all experienced the phenomenon” (Creswell & Creswell, 2018)

The purpose of this research study is to explore and determine middle and high school math teachers’ perceptions of technology integration in a math instructional environment in an urban middle and high school setting. The study evaluates how those teachers perceive technology and how they integrate it into an instructional setting. The qualitative design of the research is also intended to identify different applications for technology in the classroom, as teachers understand. “Qualitative research is an approach for exploring and understanding the meaning of individuals or groups ascribe to a social or human problem “ (Creswell & Creswell, 2018). The first step in technology integration should be a needs assessment for students and math teachers to understand their capabilities. In qualitative research, “The sample size relates to the question and the type of qualitative approach used.” (Creswell & Plano Clark, 2018)

This qualitative research study focuses on providing an in-depth analysis of the perceptions of math teachers based on their professional experiences utilizing and integrating technology in their classrooms. Also, in qualitative interviews, “Researcher conducts face-to-face interviews with participants, telephone interviews...” (Creswell & Creswell, 2018) The study outcome may result in developing a process to improve technology integration in the classroom. The following qualitative questions will be used to guide this research study:

Question # 1: What are middle and high school math teachers' perceptions of technology integration in an urban school's instructional setting?

Question # 2: How are math teachers incorporating math technology tools into middle and secondary classrooms to support math instruction for students in urban areas?

Question # 3: How do middle and high school math teachers in urban areas describe the relationship between their school's mission and technology integration?

Demographic data should be analyzed in relation to survey responses to determine factors that may contribute to teacher-reported practices and perceptions. An exploratory study of this nature provides researchers, teacher educators, and other educational professionals with a better understanding of the factors affecting teachers' use of technology in math instruction. (Higa, 2017)

Population and Sampling

The population in this research study targets math teachers in urban middle and high schools in the Hudson County area. Teachers from different districts allowed for data analysis based on different district strategies. Hidiroğlu (2021) recommended that a different perspective to the literature enriches the learning process with different dimensions and provides opportunities for rich mental processes in the mathematics learning process. In-depth qualitative interviews will be utilized to understand the teachers' opinions regarding the math tech tools and best practices in their classrooms.

According to Patton (2015), Quota Sampling allows the researcher to target participants from each grade level: "I intend to use open-ended questions to interview teachers from both middle and high school grade levels. "Open-ended questions allow participants to fully express their viewpoints and experiences." (Creswell, 2017). "Purposeful sampling is a technique widely used in qualitative research to identify and select information-rich cases for the most effective use of limited resources (Patton, 2015). This technique aligns with research provided by Morse (2019): "Using purposive sampling, I was not tied to one district pool of applicants, and it

expanded the range of information to the greater area.” (Patton, 2015) described purposeful sampling as “cases for study (e.g., people, organizations, communities, cultures, events, and critical incidences) are selected because they are “information rich” and illuminative, that is, they offer useful manifestations of the phenomenon of interest; sampling, then, is aimed at insight about the phenomenon” (p.46) then the same source added “since you can’t study everything and everyone, focus on something important and someone from whom you can learn a great deal about that matter of importance” (p.52) (Creswell & Plano Clark, 2018) “Purposeful sampling means that researchers intentionally select participants who have experienced the central phenomenon or key concept being explored in the study”(p.176)

Researcher’s Position

The researcher will be an active participant in the qualitative method study. “Qualitative research allows for rich and thick descriptions to be made of the lived experience of human beings who are on the front lines of the work that researchers are interested in exploring and subsequently improving through best practices and better approaches to the work involved in the process of teaching and learning” Hamilton (2019). Also, “ A qualitative study allows the researcher to explore the story's meanings and gain detailed firsthand accounts of the experiences (Creswell & Poth, 2018)”. The researcher is a high school math teacher at the Jersey City Board of Education. The researcher has been a math teacher in the district for the last twelve years and has been in the math teaching field for more than seventeen years. The researcher is very familiar with various technology tools, which will cause bias. The researcher is interested in further exploring the research topic and would like to investigate other professions' opinions and perceptions. The researcher explores the connections between teacher pedagogical principles and technology integration practices.

Instruments and Data Collection

To enhance the accuracy of the research study, qualitative inquirers triangulate among different data sources. “This ensures that the study will be accurate because the information draws on multiple sources of information, individuals, or processes” (Creswell & Gutterman, 2019, p. 261). The primary sources of data for this study will be surveys, in-person interviews, and online interviews. Conducting the interviews with a focus on interpretive phenomenology can help the researcher capture the lived experience of educators in the independent school setting (Frechette et al., 2020). For this qualitative research study, The interviewer will ask the following qualitative questions:

1. How do you feel about using math tech tools in your classrooms and with your students?
2. Evaluate the effectiveness of integrating technological math tools in your math classroom.
3. How do you decide what technology tool to use in your daily math activity?
4. Describe a recent use of a math technology tool that you used in your classroom.
5. Describe a recent use of a math technology tool that you thought was beneficial to your students in your classroom.
6. How can technology integration complicate the value of teaching math in high school?
7. How do you adapt to new technology math tools that you were asked to use with students at the high school level?
8. To what extent, if any, does the tech math tool integration align with the high school math curriculum?

9. Can you describe your experience when you were asked to use a new tech tool in your classroom without first being exposed to professional development/ in-service?

10. How do you replace an old math tech tool with a new one that the board of education assigned to be used?

To strengthen the credibility of the interviews, the researcher will triangulate the data collected.

Also, the research will use coding the data to collect common themes.

Question # 1: What are middle and high school math teachers' perceptions of integrating adaptive learning math technology tools in an urban school's instructional setting?

Question # 2: How are math teachers incorporating adaptive learning math technology tools into middle and secondary classrooms to support math instruction for students in urban areas?

Question # 3: How do middle and high school math teachers in urban areas describe the relationship between their school's mission and technology integration?

Validity and Reliability

The study used multiple levels for participants' ethical protection. The first was approval from the Institutional Review Board (IRB) at New Jersey City University: "The researcher will secure the data using password protection, with no one else having access to it. The code and audio recordings will be maintained for three years after the study is finalized and submitted as a final dissertation, which will be maintained and locked in a secure file only the researcher can access." Morse (2019), following all aspects of ethics and confidentiality, allowed the protection of the identity of participants and the data collected through this research study. Once the study is

completed, the results will be shared with the participants of the study in order for them to assist in judging its accuracy and credibility (Creswell & Poth, 2018).

Data Analysis

It is important to read through the data and “Examine the text database line by line, asking oneself what the participant is saying, and then assigning a code label to the text segment.” (Creswell & Gutterman, 2019, p. 263). Adu (2019) mentioned the importance of memo writing and discussed three types of memos: "initial, analytical, and procedural memos" (p. 86) The goal of data analysis is to " understand their perceptions in identifying both effective and ineffective practices; plans can be developed for training, targeting, and implementing the best or most effective practices for technology integration for individual teachers” (Morse, 2019), which adds credibility to the finding. As is true for grounded theory research, the codes would be grouped into concepts that are then developed into categories (Corbin and Strauss, 1990). Grounded theory research will be used, and the codes will be grouped into concepts that are then developed into categories (Corbin and Strauss, 1990).

The collection of additional data is also recommended, including quantitative practice data, student survey data, and data related to effective feedback. (Higa, 2017). Saha et al. (2023) noted that a good number of students around the globe are terrified of mathematics. They do whatever they can to avoid math or math-related subjects. Weng et al. (2024) Findings revealed diverse teaching aids were proposed, including digital technologies such as systems, smartphone apps, games, multimedia, augmented reality, and virtual reality, as well as manipulatives, number lines, and instructional modules. Both digital and hands-on, manipulative teaching aids have been applied in remedial mathematics interventions with promising results.

Key findings indicate the effectiveness of teaching aids depends on alignment with pupils' individual needs and suitable pedagogical approaches based on local context.

Implications emerge for developing new teaching aids and teacher training tailored to local remedial mathematics learners. Rigorous research is needed to evaluate the usability of teaching aids over time. Investing in specialized teaching aids and aligned instruction will help provide quality remedial mathematics education. This review highlights the willingness to create policy and best practice measures for their school district. further recommended that to integrate technology into the classroom properly, teachers need to be trained in the hands-on application of instructional technology.” Beginning the analysis process during the data collection stage is helpful for reflection, for creating a structural unity, and for improving the reliability of the study (Elliot, 2018; Miles et al., 2020; Kumor, 2021)

Summary

The role of math teachers in both middle and high school regarding the use of technology in teaching mathematics is crucial. Research showed evidence that the tool could improve student learning when used as an intervention or a supplement to other teaching strategies. “Technology with “tangible benefits,” and technology “has the best chance of [providing those benefits] when it targets the hardest or most time-consuming aspects of a course.” Miller (2019). Kimmons (2020) explained that technology integration improves the learning of content knowledge, such as math. When viewed this way, teachers and institutions need to consider how well new technologies will help them teach age-old content better or more efficiently and what the opportunity costs associated with a shift to new technologies are.

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Appendix: A Letter to School Administrator

Dear Ms. Leftwich,

This is Janet George. I am enrolled in a doctoral program at the Department of Educational Technology at New Jersey City University. I am seeking your consent to conduct a voluntary study at Snyder as part of a research project for my graduate coursework. Please let me know if you have any questions regarding the part of the implementation of the research at Snyder. Students' identities will be anonymous.

PURPOSE:

The purpose of this study is to collect data from interviews with teachers to record their impressions regarding the use of adaptive learning tools in the mathematics classroom.

PROCEDURES:

1. Permit Janet George to obtain consent from teachers to participate in the research.
2. Facilitate all mathematics teachers to be interviewed for approximately 10-15 minutes each.

CONFIDENTIALITY:

Any information obtained will remain confidential. All data will be stored on a secure computer and deleted once the publication has been done. Teachers' identities will be anonymous.

If you have any questions, contact me at jgeorge@jcboe.org

I consent to Snyder's participation in this research study and have been given a copy.

SIGNED: _____ DATE: _____

APPENDIX B

One-on-one Interview Protocol

Consent Page

You are invited to participate in a research project by Janet George from the Department of Educational Technology at New Jersey City University, Jersey City. This project is part of doctoral dissertation research and is conducted under the supervision of Dr. Shamburg. The interview should take approximately 45 minutes to complete.

Statement for non-participation

Your participation is voluntary, and you may refuse to participate or withdraw at any time from participating in this research project. You may also refuse to answer any question.

Purpose of the study

The purpose of the research study is to get answers to the following research questions:

Question # 1: What are middle and high school math teachers' perceptions of integrating adaptive learning math technology tools in an urban school's instructional setting?

Question # 2: How are math teachers incorporating adaptive learning math technology tools into middle and secondary classrooms to support math instruction for students in urban areas?

Question # 3: How do middle and high school math teachers in urban areas describe the relationship between their school's mission and technology integration?

Procedures

You will be asked questions related to your experience with integrating technology in your middle/high school classroom. Your responses will be recorded via Zoom/Microsoft Meet. The

responses will be analyzed and followed up with a focus group session on technology integration with the other participants in the study. “Focus groups can collect shared understanding from several individuals and get views from specific people” (Creswell & Gutterman, 2019).

Confidentiality

Your participation in this project is anonymous. Fake names will be used in this research study. There are no foreseeable risks involved with participation in this study.

Benefits

Tangible benefits in the form of incentives may be given for your willingness to participate in this study. Also, your responses to the question may lead to helping develop a plan for technology integration within the Jersey City Board of Education.

Publication Statement

The results of this study may be published in educational professional journals and used for educational purposes, such as professional presentations. However, your identification is secured and confidential.