EXPLORING THE IMPACT OF TEACHER-CREATED ONLINE ASSESSMENTS ON LEARNER ENGAGEMENT IN MIDDLE SCHOOL MATH

By

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EXPLORING THE IMPACT OF TEACHER-CREATED ONLINE ASSESSMENTS ON LEARNER ENGAGEMENT IN MIDDLE SCHOOL MATH

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Abstract: The purpose of this qualitative research study is to understand the process used for teacher-created online math assessments and the effect that online math assessments have on student engagement. Data for this qualitative study was collected and analyzed using Braun and Clarke’s (2006) thematic analysis which uses key conceptual foundations in a six-phase process. The study participants were middle school math teachers that taught a minimum of one course that required high-stakes end of year testing. Survey participants were recruited through an online survey. Data collection consisted of single interviews that were analyzed and compared. Data indicated that teachers prioritize the needs of diverse learners when creating online math assessments and when integrating technology to reinforce mathematical strategies. The data also indicated that teachers perceive the design features embedded in online math assessments to significantly influence student engagement. Finally, data indicated that technical issues and limitations pose significant challenges to the effectiveness and engagement of online math assessments.
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CHAPTER I

INTRODUCTION

In 2017, the U.S. Department of Education passed a mandate for schools to begin incorporating instructional technology into classroom lessons in an effort to better prepare 21st-century learners for careers in adulthood (U.S. Department of Education, 2017). A 21st century learner was defined by Hirschman and Wood (2018) as someone who is “highly autonomous and capable of using technology with ease” (p. 23). Nugent (2021) wrote about the impact technology will have on future careers and that “today’s learners must have basic levels of technology literacy” (p. 1). The push for using technology to facilitate learning in K12 classrooms has been one of the strongest reforms in education over the past few decades (Ahn, 2022). It is important to understand both the positive and negative elements of such a reform. While many credit technology use with improving the quality of education by offering quick access for students to stay up-to-date and well-versed in the use of technology resources (Escueria et al., 2017; Rizk & Davies, 2021), there are also disadvantages to using too much technology in classrooms (Piccorossi, 2012). For example, Piccorossi (2012) concluded that teachers in the U.S. have observed that students’ lack of skills, such as the ability to do research, has declined as they are more dependent on the technology to complete the tasks for them (Piccorossi, 2012; Ahn, 2022). To minimize disadvantages and continue the positive advancement of technology in classrooms, it is important for teachers to continuously observe student
engagement when using the devices for learning. Aagaard (2014) studied the amount of time students in classrooms used technology for off-task activities and found the more a student spends time off-task, the higher the decrease in educational performance. In this study, Aagaard found that the two main reasons for students participating in off-task activities were a lack of understanding the content and the actual structure of the lesson (2014). The design of the content was the main determining factor in the level of engagement the students had when learning the content. In addition to learning the content, engagement with assessments was also affected. According to a study by Lima et al. (2020), the perceptions students had regarding their own engagement during online assessments began to decrease as courses progressed through the semester. In this study, the decrease in student engagement was not associated with the use of online tools but rather the absence of students performing some of the proposed activities (Lima et al., 2020). Thus, it is important for teachers to understand the contributing factors to creating an engaging online assessment for students to perform at the best of their abilities.

Clark (2012) compared 199 studies related to assessment, learning, and motivation to provide a thorough analysis of the principles, theories, and objectives of assessments. Clark’s thesis for the study was that “assessment is for self-regulated learning” (Clark, 2012, p.215). In other words, providing opportunities for online assessments gives students the capability to receive feedback on their assessments in real time. Despite this seeming advantage, recent data shows there is a need for improvement in math proficiency, as only 34% of 8th graders scored proficient or higher on their end of year math assessments (U.S. Department of Education, National Center for Education Statistics, 2019). Due to the use of technology devices in today’s classrooms and the less
than proficient scores, Aspiranti et al. (2020) conducted a study to research the effect modality (online or paper/pencil) has on math assessments and found no correlation between the modality of the test and the student test scores. It is important to investigate further to determine why math assessment scores remain below average across the nation. As observed by Aagard (2014) and Lima et al. (2020), placing an emphasis on student engagement during online assessments is an important place to start research for determining whether certain online assessment design aspects motivate students to perform at their highest ability when taking online assessments.

There are multiple dimensions of engagement, and each has its own identifying attributes, which oftentimes overlap with one another. For example, Schnitzler et al.’s (2020) empirical study “explored how three aspects of engagement (participation, cognitive, and emotional) are combined within students” (p.641). This study found that typically shy students were more likely to disengage from learning opportunities, while socially outgoing students engaged for longer periods of time during instruction. Schnitzler et al., (2020) further justified their findings by explaining that “the high level of cognitive and emotional engagement within this pattern is unique with our silent students” and “the pattern of engaged students shows the most similarities with the pattern of pleasurable students…” (p. 641). Schnitzler et al. (2020) also stated, “It is therefore conceivable that participation, especially for compliant students, combines with shallow information processing rather than cognitive elaboration of the lesson topic” (p. 644).

In addition to the various dimensions of engagement, there are multiple methods of content delivery. Guthrie and Klauda (2014) examined Concept-Oriented Reading
Instruction (CORI) for middle school classrooms. During this study, student engagement was measured while observing different methods of content delivery. Guthrie and Klauda (2014) found that “multiple motivational engagement supports combined with strategic instruction for informational text increased achievement in an educationally significant classroom unit for middle school students” (p.405). With the rise of technology devices in the last two decades, Auccahuasi et al. (2021) assessed the likelihood of students becoming too dependent on technology, which in turn, potentially causes an increase in disengagement when technology is not present. This study found that engagement is typically much higher while students are on a device; however, there is not much distinction in engagement levels when comparing substitution practices on devices, such as homework problems, when compared to paper format.

Substitution practices are defined as the first stage in a four-stage framework, known as SAMR, developed in 2006 by Ruben Puentedura. Puentedura (2006) defined the four stages of SAMR as Substitution, Augmentation, Modification, and Redefinition. Substitution is the most basic stage where technology is used to substitute for traditional practices (Puentedura, 2006). Augmentation adds to the substitution stage by contributing a factor that will functionally improve the intended outcome (Puentedura, 2006). A significant task redesign with the use of technology is found in the modification stage, and the redefinition stage is when “tech allows for the creation of new tasks that were previously inconceivable” (Puentedura, 2006). Thus, as noted by Auccahuasi et al. (2021), levels of student engagement may vary depending upon the stage of SAMR being incorporated with the use of technology.
While there have been many studies conducted to examine student engagement, and more recently student engagement specific to online learning, there is a lack of research on student engagement levels when students complete online assessments. Research by Kay and LeSage (2009) found that students had lower levels of engagement when taking online assessments compared to paper versions of the same test. However, it is important to also consider that Aspiranti et al. (2020) found no correlation on the overall assessment scores when students were tested using different modalities. With the increase of technology integration in schools, there is an important need to analyze the design and delivery of online assessments and how those factors can affect student engagement and outcomes. This study examined how teacher understanding of student engagement impacts the development of assessments that K12 teachers use when creating engaging online assessments for students in a math classroom.

**Background of the Problem**

According to the results of the 2022 National Assessment of Educational Progress (NAEP), Oklahoma schools remained below the national math scores, which has occurred each consecutive year since 2000 (National Assessment of Academic Progress [NAEP], 2022). The NAEP is used with students in fourth and eighth grades and randomly selects schools and classrooms across the nation. The data is compared on a national level to examine trends in achievement gaps across all 50 states. The NAEP website states that “teachers, principals, parents, policymakers, and researchers all use NAEP results to assess progress and develop ways to improve education in the United States” (NAEP, 2023). As the continual trend of Oklahoma eighth graders remains
below the national average for mathematical content for the past 23 years, it is imperative for these gaps to be identified and targeted for these scores to increase towards the national average.

In addition to the consistent scores below the national average in mathematics, there is an alarming number of emergency certified teachers in the classrooms. In the 2022-2023 school year alone, more than 2,500 classroom teachers were emergency certified with over 200 of those in a middle school math classroom (Oklahoma State Department of Education [OSDE], 2022). These teachers did not receive any pre-service teaching experience and likely had not previously enrolled in college courses which would typically set a foundation for mathematical education and teaching. The lack of mathematical foundations and lack of knowledge to identify and target deficiencies in math does not lend itself to closing the wide learning gaps in Oklahoma schools.

**Background of Technology in Education**

Technology can be found in almost every classroom across the U.S. today. Before 1980, there were few computers in classrooms; however, they began to slowly enter classrooms at the start of the 1980s. By 1983, the interest for using computers as a form of instruction quickly grew to such an extent that they were being used in 40% of elementary schools and 75% of secondary schools (Reeser, 2001a). While the excitement of this innovation spread across school districts, there were also critics of the computer movement in education. Just a few years later, Streibel (1986) took a somewhat opposing stance when he shared his personal assumptions that computers would limit students in attaining high levels of intellect, “alter the sub-skill acquisition”, and would reduce human interaction (p.158). Considering potential drawbacks is generally part of most
scientific progress, though, and the skepticism surrounding computer usage in schools did not slow the evolution of instructional technology.

Media use for instructional purposes has grown exponentially since 1995, specifically for computers and the Internet, as the vast majority of schools have adopted technology practices to enhance student learning (Reiser, 2001b, p. 60).

**Importance of Assessment**

Assessments are used to evaluate a person’s knowledge and understanding of specific standards or skills. National Research Council (2014) found that to determine if students have met their learning goals and to properly differentiate instruction for students, they must be assessed whether that be formally or informally. One of the *Five Essential Elements* of effective school mathematics programs as defined by The National Council of Teachers of Mathematics (NCTM) is meaningful and aligned assessment (p.59). NCTM defined assessment as “the process of gathering evidence about a student’s knowledge of, ability to use, and disposition toward, mathematics and of making inferences from that evidence for a variety of purposes” (p.3). Along with this definition, NCTM states,

An excellent mathematics program ensures that assessment is an integral part of instruction, provides evidence of proficiency with important mathematics content and practices, includes a variety of strategies and data sources, and informs feedback to students, instructional decisions, and program improvement (NCTM, 2014, p.89).

There are many ways to assess a student that is not a direct quiz or assessment. An informal assessment approach used in classrooms can be executed
by using formative assessments. A formative assessment is typically used to gather more information on student learning to help identify and address learning gaps. Leenknecht et al. (2021) found that “formative assessment affects students’ learning and vice versa” and concluded that “formative assessment can be seen as an integral part of teaching and learning” (p.236). Teachers can take the data from formative assessments to drive their current instruction, including intervention practices. On the contrary, a summative assessment is a widely used testing instrument that is assigned to all students and often has a grade attached to it. While summative assessments can provide the teacher with learning gaps over specific content areas, these assessments are typically given at the end of major units once all instruction has been taught.

Assessments are often seen or felt as an obstacle that both students and teachers must overcome to advance to the next step. This common practice is because “assessment traditionally tends to emphasize the evaluation of student achievement (e.g., the assignment of grades), and more recently, the rating of schools and the performance of teachers (NCTM, 2014, p.89). Assessments should be seen as an ongoing process and beliefs about assessments have been broken into two categories: unproductive beliefs and productive beliefs. Productive beliefs, as defined by NCTM (2014), influence assessment practices in a positive way by “improving the teaching and learning of mathematics”, “embedding in instruction to support student learning”, consist of “multiple data sources”, and “should use a variety of assessment strategies and tasks” to accurately measure student understanding (p.91). Unproductive beliefs, as defined by NCTM (2014), can negatively influence the assessment practice are: using assessments as...
“accountability for students through report cards or grades”, as “an interruption of the instructional process”, contain a limited type of question formats that are objective, and using “a single assessment to make important decisions about students and teachers” (p.91).

**Online Assessment**

The integration of technology into classrooms has given teachers the ability to use online assessments to identify educational gaps, while also providing immediate feedback to students. A study conducted by Kuhfeld and Soland (2020) identified that for assessments to show a true reflection of a student’s content knowledge, the student must be engaged during the process (p.147). Research showed that students using a ‘rapid guessing’ approach while taking an online assessment lowered their performance (Kuhfeld & Soland, 2020). Rapid guessing is measured by the length of time it takes a student to answer a single question on an assessment before moving to the next question. Parameters are set for the average time a student should spend on each question and if the student answers too quickly, it is assumed the student answered rapidly. Using online platforms for assessments has the capability to provide opportunities for a more individualized learning experience for the students by providing immediate interventions based on their performance on assessments (Uncapher, 2018).

Assessments can be learner-centered, which shifts the overall focus to the learner’s progress and can be given in the form of “projects, written assignments, portfolios, and performances that provide a greater emphasis on higher-order thinking skills” (Archambault et al., 2022, p.185). Teachers dedicate their professional lives to teach students the essential skills they need to be successful in the future. Assessments
serve as crucial instruments for tracking knowledge to determine if progress is being made. With the opportunities available for online assessments to be integrated into today’s classroom, it is important to understand what drives the students when performing on these assessments.

**Math Assessments in Middle School**

Assessments are used to measure the understanding of concepts possessed by students. Teachers collect data from assessments for three primary reasons. First, they analyze class-wide data to tailor their instruction to align with the overall content and key concepts. The second way collected data is used is to implement targeted interventions for each student to address content gaps. Finally, assessment data is a tool for monitoring the progress of individual students, as well as the whole class, throughout the school year. With the assessment results, “teachers will be more effective in helping students to improve their understanding of key principles” (Phelan et al., 2011, p.338). When assessments are used correctly and to provide strategic interventions for students at grade level and below, the effect size on student learning is 1.07. This effect size means that schools using Response to Intervention (RtI) have a greater impact on student outcomes (Barlow, 2017).

Students with low confidence in math often perform lower on assessments than their peers with a higher confidence level (Beesley et al., 2018). Clarke et al. (2014) found that middle school teachers often oversimplify assessments or provide an ample amount of help for students during assessments when working with lower-achieving students (p.4). When assistance is amplified during assessments, the data often becomes misleading. Because students are given assessments to determine specific abilities there
must be fidelity and commonality with assessment procedures to gain a true understanding of the students’ competency levels in each specific skill.

**Teachers and Assessment**

Teachers should be provided professional development that directly focuses on how to create student assessments. One study found that elementary teachers must hold a significant amount of pedagogical content knowledge, while secondary teachers would only need to be knowledgeable in their specific area of expertise (Heitink et al., 2016). While there are a multitude of computer-based learning programs that provide student assessments as their specialty, it is important that teachers have opportunities to learn how to create the assessments within their own classrooms and for their own students. Teachers possess the unique ability to address specific needs of their students to effectively differentiate the learning environment.

A 2021 study by Herron & Wolfe found that “the study of instructional design, a core element of digital learning transformation, has not permeated teacher education programs” (p. 320). Herron & Wolfe’s (2021) study strategically identified the disconnect between pre-service teacher programs and teacher-created assessments. A second study conducted by Coombs et al. (2020) also found that early career teachers lack knowledge and skills when it comes to developing summative assessments (p.9). With the ever-increasing presence of technology in K12 classrooms, it is vital that teachers understand the basics of instructional design and the role it plays in a classroom.
Problem Statement

With the steady increase of available technology in classrooms today, it is vital to understand effective ways to use the devices to increase student knowledge and content retention. Math classrooms pose a higher risk for student lack of engagement while taking online assessments as students prefer to take a math assessment using paper and pencil because it is easier to show their work (Aspiranti et al., 2020). It is of equal importance to understand how online math assessments can be designed to be engaging and the process teachers go through when creating their online assessments. The problem this study addresses is the lack of training teachers are given to design engaging online assessments and the absence of digital components that have the potential to increase student engagement.

Purpose of the Study

The purpose of this qualitative study was to explore how teachers conceptualize and create online math assessments to actively engage middle school students. The study examined the benefits and challenges associated with online assessments and the impact online assessments have on student engagement. By identifying strategies used by educators in creating assessments, the study uncovered benefits and challenges associated with the implementation of online assessments in a middle school math classroom. Additionally, the study explored the advantages and disadvantages for online assessments and the affect they have on student engagement in a middle school math classroom.

With the increase in technology in all K12 schools, it is evident that there are disparities across content areas and grade levels on student performance (U.S. Department of Education, National Center for Education Statistics, 2019). It is important
to identify what teachers recognize as increasing engagement for students, as well as disengagement, when taking math assessments online. It is also important for the teachers to reflect on common practices already in place when designing online assessments to determine what has the most impact on student achievement.

Therefore, this study addresses the following questions:

RQ 1: What factors do mathematics teachers prioritize when conceptualizing the design process to create engaging online assessments?

RQ 2: How do mathematics teachers incorporate technology and interactive components into their online math assessments?

RQ 3: What are mathematics teachers' perceptions regarding the influence of these elements on student engagement and learning outcomes?

RQ 4: What challenges do mathematics teachers face when creating online math assessments, and how do they adjust their approaches to overcome these challenges to ensure the assessments are both effective and engaging for students?

**Epistemological Perspective**

The researcher aligned this study within a constructivist perspective. A constructivist approach is typically used with qualitative studies to better understand the participants’ subjective views, which allows the researcher to understand phenomena and how social interactions with others have shaped the worldviews of the participants (Creswell & Plano Clark, 2017, p. 36). Creswell and Plano Clark (2017) also go on to state that “transformative worldviews are focused on the need for social justice and the pursuit of human rights” (p.37). This perspective allowed the researcher to understand the participants’ perspectives. The participants were asked questions related to their
personal experiences and perceptions of classroom engagement and designing online math assessments. The constructivist perspective allowed these participants to use their own social interactions and prior experiences to expound upon the interview questions.

**Theoretical Framework**

This research employed Design Theory to better understand the cognitive planning processes that teachers engage in while developing assessments for students. The theory was derived by the work of Simon (1996) when finding a way to define the design of problem-solving. Simon (1996) stated, “Everyone designs who devises courses of action aiming at changing existing situations into preferred ones,” and went on to say, “Design is the core of all professional training” (p. 111). There are several theoretical approaches that assist in understanding, explaining, and describing knowledge and practice that live under the Design Theory umbrella. Research by Hatchuel (2001) used the term, “learning-devices” which are processes to find solutions, or in better terms “to learn about what has to be learned or could be learned” (p.266). In a classroom, this is a daily occurrence through formative and summative assessments.

The overall goal of the study was to examine the process of teacher-designed online math assessments and the considerations teachers considered while designing an online math assessment that prioritizes student engagement. Understanding design techniques is essential when developing online math assessments engaging to students, seamlessly integrating them into a present-day classroom environment, and easily integrating successful design aspects students to quickly adapt to a new format for online assessments.
Definition of Terms

Comprehending key terms is essential for research. The following is a list of key terms and what they mean for this study.

**Asynchronous.** Learning on one’s own schedule and not in a group setting.

Asynchronous learning is a common practice in online and hybrid schools.

**Devices.** A wireless computing device that has typing and internet capabilities.

**In-Person Learning.** Learning that takes place inside a school building.

**Learning Management System (LMS).** An online application that allows for student and teacher interaction as well as a location to submit assignments and complete assessments.

**Middle School.** Grades fifth through eighth in a K12 school district. Students are between the ages of 10 and 14.

**Online Assessments.** Assessments that are completed online using a learning management system or other digital platforms.

**Synchronous.** Participating in a simultaneous activity, whether in-person or online.

**Teacher.** A person teaching students in a school setting.

**Technology Literacy.** The ability to use technology effectively and responsibly.

Summary and Organization of the Study

This research study represents the impact online assessments have on student engagement in a middle school math classroom. The report is organized into five chapters. Chapter I begins with the history of technology use in a middle school classroom as well as the purpose of the study, and the research questions used to guide the study.
Chapter II is a literature review that correlates closely with the topic being studied. Topics discussed in this chapter are the history of educational technology, student engagement with online assessments, student engagement with online learning, teacher-designed online assessments, and teacher perceptions on the effectiveness of online assessments.

Chapter III describes the methodology used in this study. Research design, participant recruiting, and procedures used during the study are included in this chapter.

Chapter IV presents the findings of the research and describes the review of data. All data collected through the survey questionnaire and the virtual interviews is explained fully in this chapter.

Chapter V presents the findings of the study, conclusions, and the implications derived in the research. Future recommendations for this research are included.
CHAPTER II

REVIEW OF THE LITERATURE

Introduction

This study investigates the diversity of methods used by middle school math teachers when creating online math assessments that are engaging to students. With the ever-growing number of technology devices in schools today, it is imperative that students are given opportunities to exhibit their knowledge of the content without technology acting as a barrier. This research aims to identify the advantages and disadvantages of design aspects for online assessments. The review of literature for this study will focus on three main subject areas: (a) the importance of student engagement for online math assessments; (b) design of assessments; and (c) the process used for teacher-created assessments.

Organization of the Chapter

Professional literature was reviewed for this chapter to better inform the reader of current processes, both positive and negative, for engaging assessments administered online in a middle school setting. To begin, this chapter provides research and examples that support engagement for middle school students. The examples range from class participation that involve engaging approaches as well as aspects of assessments that can hinder student success. Next, studies are shared that describe varying designs used when
creating online assessments. This research will include articles of research found in pre-service teacher programs as well as continuing professional development opportunities for teachers. Finally, research will be shared that examines the current processes used by teachers and the pedagogical principles that are incorporated during the design.

**Middle School Student Engagement**

As mobile technology continues to increase in school settings, it is imperative to understand the effects it has on student success. There is an assumption that student motivation and learning will continue to improve as technology increases in these settings (Aagaard, 2015). With ever evolving technology programs and platforms, it would be naive to think there could only be positive improvements in classroom settings. Aagaard (2015) found that students often experience habitual distractions when working on technology devices in classrooms and oftentimes have to close the lids of their devices in order to stop the alluring distractions.

A study conducted by Ravizza et al. (2014) found that students scored lower on assessments when taking them online and found it possible that students are not efficient at multitasking when given access to the internet for browsing purposes while taking an assessment. This study also found it evident that students had lower test scores when taking online assessments and that there was lack of self-awareness that off-task online activities could be the culprit of such low scores. Although the authors did not include limitations in their writing, it is important to note that during this study there was no use of lock-down browsers, which prohibit students from accessing anything other than the testing window, or any restrictions on the device functionality when students were taking the assessments (Ravizza et al., 2014).
Teachers and administrators must ensure that students are actively engaged in their learning. Behavioral Engagement for students was described by Leon et al. (2017) as supporting the student needs of autonomy, competence, and relatedness. This study found that behavioral engagement has “a predictive power for grades” (Leon et al., 2017, p.9). Students must learn to be persistent when they are losing interest or find an activity or assessment boring. It is important that students feel a sense of belonging in the class to help them reach a high level of engagement for all tasks, including tedious tasks.

Fredricks et al. (2004) identified three dimensions of engagement which include behavior, emotional, and cognitive. Each of the three types of engagements identified by Fredricks et al. (2004) has its own unique defining characteristics; however, there is often some overlap between the three. Fredricks et al. (2004) defined behavioral engagement as possessing positive conduct, involved in learning, and participating in school-related activities (p. 62). Emotional engagement refers to students’ affective reactions in the classroom, while cognitive engagement emphasizes investment in learning and self-regulation (Fredricks et al., 2004, pp. 62-63). Al-Bogami and Elyas (2020) wrote, “The more the students actively focus and participate in class, then more likely they will be able to learn, retain information, and find school more enjoyable” (p.3). In this regard, it is a top priority that teachers provide content and resources that continue to support student engagement, whether this is with or without technology devices. A mixed-methods study was conducted to evaluate engagement with iPads among middle school girls. This study found that the use of iPad apps increased the participation among the students and enabled them to stay on task while also motivating their learning and “enhancing their sense of enjoyment” (Al-Bogami & Elyas, 2020, p.11). Teachers that
are finding creative ways for students to use technology in their classrooms are finding that students are more engaged.

While searching for better ways to engage students, particularly in a mathematics class, it is important to understand how mathematics develops along learning progressions. While establishing mathematics goals to focus learning, NCTM (2014) addresses that the purpose of each lesson must not be a mystery for students and that “it is important that students understand the mathematical purpose of a lesson and how the activities contribute to and support their mathematics learning” (p.13) These goals must be established in every component of learning in a math classroom, including before the initial lesson, throughout student discourse, and when asking students to complete an assessment.

One way teachers accomplish this feat is by incorporating Three-Act mathematics tasks, which engages students by incorporating real-world problems and leveraging the information given to the students to increase their engagement to solve the problem. Redmond-Sanogo et al. (2018) created a rubric that included the use of technology when incorporating Three-Act mathematics tasks into classrooms and stated that,

Three-Act Tasks provide opportunities for both problem posing and problem solving in a creative digital format that leverages the strengths of the digital tools with the power of relevant, contextual stories to highlight the kind of mathematics situations students could find themselves in outside of school (p.143).

By using practical ways to identify the evidence of student learning and by providing clear goals prior to learning, “students can then gauge and monitor their own
learning progress”, which allows them to invest more deeply in their learning (NCTM, 2014, p.17).

**Online Assessment Capabilities in Education**

When taking math assessments online, students can manipulate certain aspects of the assessment and engage deeper with each question. There are many mathematical concepts in which moving an item around, or simply having a digital ruler accessible to move around and resize on the computer screen can assist students with developing conceptual thinking to apply their learning to real life situations. Stacey and William (2013) stated that:

> A computer-based assessment platform offers an infrastructure for communication that can enhance item presentation, the range of mathematics assessed, interaction between the student and the item, the way in which the response is provided by the student and the information that is extracted from the response” (p.726).

Along with the opportunities presented for taking math assessments through an online platform for regular education students, there are also many features that can greatly increase student success for all learners, including English learners and students with exceptional needs. An overwhelming number of online platforms now include Universal Design (UD) in their content creation, which can include adaptation products such as text-to-speech for developing readers, along with font size and color options for visually impaired students.

A study conducted by Kearns (2012) found that using an online format for assessments also allows affordances to teachers, such as “self-check quizzes give
instructors a way to informally assess students’ understanding as well as supply feedback to help them correct misconceptions” (p.203). Online assessments have the capability to provide better time-management strategies for teachers by automatically grading and syncing with the gradebook, which saves teachers time. In addition to a faster method of grading, teachers can annotate on assignments, as well as insert voice memos, and return this feedback to their students immediately. Feedback is an essential element to student growth that was found to have an effect size of 0.70 in Hattie’s meta-analysis study of the influences related to student achievement (2008). In layman’s terms, students that were given effective feedback outperformed 69 students that did not receive effective feedback.

When each of these online components are accessible for both teachers and students, it enhances the ability to grant access to learners at every developmental stage and facilitates efficient methods for gathering, assessing, and distributing data.

**Assessments in Mathematics**

Assessments play a pivotal role in a middle school mathematics classroom by evaluating student understanding of the content, tracks progress, and guides instructional decisions. The significance of effective assessments in mathematics cannot be overstated as it is the foundation for fostering critical thinking, problem-solving skills, and logical reasoning among students. Assessments should “support the learning of important mathematics and furnish useful information to both teachers and students” (NCTM, 2000, p.22). Suurtamm et al. (2018) placed assessments into two categories: large-scale assessments and classroom assessments. Classroom assessments is used on a small-scale to understand student knowledge of a concept and to make decisions for individual
student learning, while “large-scale assessments inform systems” (Suurtamm et al., 2018, p.3). For this research study, the researcher will concentrate on classroom assessments because the purpose is to evaluate current practices of teacher-created assignments and the effect they have on student engagement. When creating assessments for students, teachers cannot locally control the assessments used for large-scale assessments.

Classroom assessments in mathematics are not always analyzed appropriately, which can lead to a downward spiral effect on instruction. To this point, some teachers view assessments as a way to collect a grade for students instead of using the assessment to develop individual learning goals and differentiated instruction for students. Effective assessments provide useful information to teachers and students about all components of learning mathematics for students (NCTM, 2014). A study conducted by Mahlambi (2023) suggests that “mathematics teachers need to recognize the importance of assessment for learning principles in attending to the learning needs in the classrooms”, which enables the classroom to promote the diversity of learners in the classroom (p.6). Teachers need to continue shifting “the primary focus and function of assessment from accountability to effective instructional practice.. to ensure mathematical success for all students” (NCTM, 2014, p.98). When the shift of leveraging assessments is achieved, instruction and student learning will both improve.

**Design of Assessment**

A systematic literature review by Brownlie et al. (2023) aimed to understand the contributing elements of creating an effective summative assessment. The 2023 study found that in order for teacher-created assessments to be recognized as effective, they must consider and balance five principles: “validity, reliability, fairness, authenticity, and
flexibility” (Brownlie et al., 2023, p. 10). For teachers to determine if a student is proficient in specific content areas, they must be assessed. The assessment should be created to provide data that will assist teachers in developing strategies to improve their learning over the school year (Uncapher, 2018, p.63). Uncapher (2018) explains that learning should occur in a “closed-loop” process that consists of a repeated cycle of assessments to determine the current proficiency of the student and immediate interventions to focus on specific deficits in the student’s knowledge and understanding of the content.

Formative assessments are another way to quickly identify learning gaps in the classroom for specific skills. Beesley et al. (2018) identified the three most important practices involved with formative assessments: “(a) students’ understanding of their learning goals and targets, (b) the criteria by which they will know how they are progressing with their learning, and (c) what needs to be done next to move learning forward” (p.5). Stiggins and DuFour (2009) wrote that “formative assessments done well, represents one of the most powerful instructional tools available to a teacher or a school for promoting student achievement” (p.640). Both summative and formative assessments are crucial in developing lesson plans for whole group instruction as well as individual interventions in a math classroom.

When designing assessments for mathematics, it is important for teachers to include “rich tasks that provide opportunities for students to engage with problems of interest to them” (Suurtaam et al., 2018). This allows students to feel a sense of ownership in their learning. Van den Heuvel-Panhuizen & Becker (2003) suggested that
assessments for mathematics should include problems that are designed using the following principles:

- Tasks have multiple solutions so that students can make choices and use their natural thinking and reasoning abilities.
- Tasks might be dependent, that is, tasks might be paired or contain multiple parts where a solution on an earlier part is used to make progress on a subsequent part or subsequent problem.
- Tasks where what is of interest is the solution strategy rather than the actual answer.

It is important for teachers to ensure they are assessing students over conceptual understanding, reasoning, and procedural fluency. NCTM (2014) states that “the evidence obtained [on an assessment] depends on the questions and tasks used. Furthermore, by utilizing the tasks outlined by Van den Heuvel-Panhuizen and Becker (2003) and aligning them with the research conducted by NCTM, it reinforces the significance of how teachers structure their assessments to facilitate learning.

**Processes for Teacher-Created Assessments**

Numerous companies can be found online, boasting their ability to assist teachers in creating assessments for their classroom. However, it is crucial for classroom teachers to have the autonomy to develop assessments based on their firsthand understanding of the classroom environment, the design of instruction, and the ability to identify the key skills to assess. DeLuca and Klinger (2010) found there is a lack of training for classroom assessments in pre-service teacher programs. This lack of sufficient training can increase
the dependability teachers have on already created assessments found through textbook publishers or other sources. Teachers should be empowered to leverage their professional knowledge to create assessments tailored to the unique needs of the students in their classroom. This ensures a more effective and relevant approach to evaluating student learning. Stiggins and DuFour (2009) created a structure with four conditions that must be satisfied for students at all levels to work productively:

**Condition #1: Clear Learning Targets**

Learning targets must be within the developmental reach of students and integrated through daily instruction. The students must have time to learn the content being targeted before given an assessment to gather data as to their knowledge of the content. A teacher's role in setting clear learning targets is to evaluate the most vital learning that must occur within each standard (essential standards) and help students achieve them (Stiggins & DuFour, 2009, p. 643).

**Condition #2: A commitment to standards-based instruction**

The primary purpose of assessments is to collect data to use as a valuable tool for enhancing classroom instruction and differentiating the content to meet the individual needs of each student. By focusing on this end goal, an assessment should never be used to merely collect a grade or rank a student, but to ensure each standard is being targeted for student achievement. (Stiggins & DuFour, 2009, p. 643)

**Condition #3: High-quality assessment**

It is essential that teachers choose appropriate methods aligned with their learning targets to create an effective assessment. Each assessment should be created with a variety of components, such as multiple-choice items, performance tasks, or essays with
an ample number of questions to gather enough data to confidentially assess student growth, as well as learning gaps in the content. (Stiggins & DuFour, 2009, p. 643)

**Condition #4: Effective communication**

Effective communication should include timely feedback to students with suggestions for improvement. Providing non-judgmental, yet instructional feedback will inform the student on how to perform better on the next assessment. Teachers must ensure the students understand the assessments is a direct focus on the student’s work and not the student as a person. (Stiggins & DuFour, 2009, p. 643)

While various online platforms, including textbook publishers, offer support for creating or using classroom assessments, it remains imperative that teachers retain the autonomy to create assessments that align with their firsthand knowledge of the dynamics in their classroom, design of instruction and the skills they are targeting. DeLuca and Klinger’s (2010) research provided evidence of the deficiency in pre-service teacher programs related to classroom assessments, which potential leads teachers to heavily depend on premade assessments from textbooks or other sources. Empowering teachers to use their professional expertise to create assessments that suit the specific needs of the students in their classrooms ensures a more effective approach to evaluating learning outcomes. As outlined by Stiggins and DuFour (2009), adhering to the four conditions (clear learning targets, commitment to standards-based instruction, high-quality assessment design, and effective communication) encourages student engagement. By making these conditions a priority, teachers can create an environment that is conducive to using assessments to foster student growth and achievement.
Comparing Online and Traditional Mathematics Assessments

In recent years, advancements in technology have changed the education by offering new possibilities for teaching and assessments. As teachers navigate how to incorporate digital tools into their traditional practices, a debate continues over the effectiveness of online assessments compared to the traditional method of paper and pencil. There are many key differences to consider when comparing the two modalities of assessments including accessibility, technology integration, data analysis, equity and access, and alignment to instruction.

Online assessments increase accessibility for student populations by reducing barriers and address individual needs and differences. To address the diverse needs of learners, a research-driven framework was developed to enhance teaching and learning using strong data to how people learn. This framework, Universal Design for Learning (UDL) has three main principles to aid in the use of technology to support learning. The 2024 National Educational Technology Plan, created by the US Department of Education stated the three main principles of UDL as:

**Multiple Means of Representation**- Digital tools can allow educators to present information in multiple ways.

**Multiple Means of Expression**- Digital tools can provide ways for students to demonstrate their understanding of learning concepts.

**Multiple Means of Engagement**- Digital tools can provide interactive learning experiences and multiple ways of engaging with learning material (p.21).
Figure 1 provides examples of technology integration opportunities in classrooms based on each of the three UDL principles. In the absence of an online assessment, the majority of these accessibility options are unavailable to students, and if available will add extra work time for teachers to enlarge text size or to find time to read an assessment aloud to a student. In addition to the extra time it may take teachers to create a traditional assessment, it will also take time to grade each assessment. When assessments are taken online, the automatic grading feature offers greater efficiency for teachers.

On the contrary, online assessments are not equitable across the entire state because of the barriers presented with internet access. Although there has been significant growth in the availability of internet in schools, “many communities still lack access to reliable, high-speed broadband and technology tools” (US Department of Education, 2024). Without guaranteed internet access for all learners, many teachers have no option but to continue using the traditional assessment method of paper and pencil.
Figure 1

UDL Examples by Principle

Teacher Perspectives for Online Assessments

The integration of technology in modern education has reshaped instructional practices in classrooms by offering educators new tools to enhance student learning experiences. A 2020 study by Abdou found that “teachers expressed positive attitudes towards techniques/methods used in online assessments” however “the majority of them encountered serious challenges in online assessments” (p.16). Serious challenges presented were lack of knowledge of technology platforms and unstable internet connections. Another factor that may affect teacher perspectives of online assessments is the grade earned on the assessment. Depending on many variables, students may score
higher or lower when taking assessments online compared to traditional paper and pencil assessments. Findings from Backes & Cowan’s (2018) study highly encourages school districts to take the mode of assessment into account when looking at test scores because they found strong evidence of “students scoring lower on computer-based tests that cannot be explained by preexisting trends” and was continued into the second year of online testing (p.19).

Ertmer (1999) shared that “teachers with a limited amount of training may begin using technology with current levels of knowledge and skill or wait until sufficient levels have been obtained, depending on how significantly they weight their own lack of training” (p.52). Merriam-Webster defines perspective as “a mental view or prospect; the interrelation in which a subject or its parts are mentally viewed”. It is important to understand that teacher perspectives are based on prior experiences and that the perspectives they bring to their classroom will influence the learning environment.

While more professional development may seem like the answer to address the negative perspectives associated with online assessments, a literature review by Tondeur et al. (2017) found that “not all teachers will benefit from a professional development intervention” (p.567). It is important that teachers understand their pedagogical beliefs must exist to increase educational technology use when attending professional developments specific to technology (Tondeur et al., 2017).

**Summary**

While there are many companies and programs that offer assistance in teacher-created assessments, it is imperative that teachers continue to have the opportunity to create and tailor assessments using the firsthand knowledge of the students they
teach. This autonomy will empower teachers to create assessments that effectively address the unique needs of their students. As outlined by Stiggins and DuFour (2009), the four conditions—clear learning targets, a commitment to standards-based instruction, high-quality assessment, and effective communication—provide a structured framework for ensuring student engagement and achievement. By following the four conditions above, teachers can foster a learning environment that promotes constant learning and skill retention for ultimate student success.
CHAPTER III

METHODOLOGY

Introduction

The purpose of this study is to investigate the methods used by middle school teachers when designing online math assessments that engage students. The research identifies advantages and obstacles found with online math assessments and their influence on student engagement, while actively identifying barriers teachers face when creating engaging assessments. This chapter provides a detailed description of the methods used for the research as well as presents the thematic analysis.

Research Questions

The following research questions will guide the study to explore the topic regarding student engagement when taking a math assessment online:

- **RQ 1:** What factors do mathematics teachers prioritize when conceptualizing the design process to create engaging online assessments?
- **RQ 2:** How do mathematics teachers incorporate technology and interactive components into their online math assessments?
- **RQ 3:** What are mathematics teachers' perceptions regarding the influence of these elements on student engagement and learning outcomes?
• **RQ 4:** What challenges do mathematics teachers face when creating online math assessments, and how do they adjust their approaches to overcome these challenges to ensure the assessments are both effective and engaging for students?

The purpose of each research question, the data used to answer the questions and the data source can be found in Table 1 below.

**Table 1**

*Research Data Matrix*

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Purpose</th>
<th>Data to Answer Question</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>What factors do mathematics teachers prioritize when conceptualizing the design process to create engaging online assessments?</td>
<td>To determine if teachers follow district expectations and provided platforms when creating assessments</td>
<td>Transcribed and analyzed participant interview data &amp; survey</td>
<td>Semi-structured interview questioning with open-ended questions &amp; survey results</td>
</tr>
<tr>
<td>How do mathematics teachers incorporate technology and interactive components into their online math assessments?</td>
<td>To learn the different approaches teachers use with online math assessments</td>
<td>Survey Questionnaire and transcribed and analyzed participant interview data</td>
<td>Semi-structured interview questioning with open-ended questions</td>
</tr>
<tr>
<td>What are mathematics teachers' perceptions regarding the influence of these elements on student engagement and learning outcomes?</td>
<td>To confirm or disprove that interactive components affect learner engagement when taking online math assessments</td>
<td>Transcribed and analyzed participant interview data</td>
<td>Semi-structured interview questioning with open-ended questions</td>
</tr>
<tr>
<td>What challenges do mathematics teachers face when creating online math assessments, and how do they adjust their approaches to overcome these challenges to ensure the assessments are both effective and engaging for students?</td>
<td>To understand common challenges and the ability or not to improve the tool</td>
<td>Transcribed and analyzed participant interview data</td>
<td>Semi-structured interview questioning with open-ended questions</td>
</tr>
</tbody>
</table>

Each of the four research questions had a purpose to address the needs of the study. Table 1 shows the purpose of each research question as well as the data used to answer the question. Research Question One was to determine if teachers followed
district expectations and provided platforms when creating assessments. Research Question Two was used to learn the different approaches teachers use when creating online math assessments. Research Question Three was to confirm or disprove that interactive components affect learning engagement when taking math assessments, while the final research question was to understand common challenges and the ability to improve the learning tool.

**Research Design**

This dissertation study used a qualitative methodology to gain a better understanding of student engagement with online testing. Qualitative research is known for the use of words in the data collection process, which includes semi-structured or open-ended questioning. This type of questioning technique allows the researcher to gather data from participants relating to experiences and observations of the research topic (Creswell, 2007). Current teacher perceptions and obstacles were identified, as well as improvements to be made when designing online assessments. A qualitative approach was the most fitting type of data to collect because the interview questions targeted middle school math teachers regarding the barriers they face while creating the engaging student assessments.

Merriam (2001) listed six advantages of a qualitative case study:

1. Illustrate the complexities of the situation;
2. Have the advantage of hindsight yet can be relevant in the present;
3. Show the influence of personalities on the issue;
4. Include vivid material—quotations, interviews, and so on;
5. Spell out differences of opinion on the issue and suggest how these differences have influenced the result;

6. Present information in a wide variety of ways and from the viewpoints of different groups (p. 30-31).

This study used a constructivist approach (Creswell & Plano Clark, 2017) as the epistemological perspective to guide the interview by asking the participants to explain their perceptions, social integrations, and prior experiences they have encountered for student engagement with online assessments. Creswell and Plano Clark (2017) explain that the subjective views of a participant and the ability they have to connect with current phenomena make up the constructivism worldview. The set of assumptions used with qualitative studies often take a constructivist approach because of the strong personal views (Creswell & Plano Clark (2017). This study was performed to understand teacher-created assessments and the understanding teachers have with student engagement.

Creswell and Plano Clark (2017) describe how phenomena is formed “through participants and their subjective views” and continue their explanation by stating “when participants provide their own understandings, they speak from meanings shaped by social interaction with others and from their own personal histories” (p.36). The constructivist approach will allow the researcher to examine multiple factors, including societal factors and changes, that have an effect on student engagement with online assessments.
Methods and Participant Selection

A qualitative study allowed the researcher to examine the current practices in place for teachers creating engaging online math assessments. Creswell (2009) stated, “The idea behind qualitative research is to purposefully select participants or sites that will best help the researcher understand the problem and research questions” (p. 178). The participants for this study were Oklahoma teachers that currently teach middle school math. These participants were appropriate for this study due to the access they have to compare the different modes of online assessments.

Survey

A list of emails was derived from a certified teachers list that was updated in November 2023 on the Oklahoma State Department of Education website. After downloading the spreadsheet, it was filtered using the term ‘math’ in the teaching assignment field. From those results, the researcher looked at the school site for each math teacher to determine if it was an elementary, middle, or high school level site to ensure middle school teachers would receive the email. In addition, the survey was sent to 8 district math coordinators to distribute to the middle school math teachers in their districts and was also posted on Facebook and X, which likely impacted the overall response rate. The administration of the survey resulted in 61 responses, although 46 completed the survey in its entirety. Of the 61 responses recorded, 9 respondents did not agree to the consent question, which was the first question. After the consent question, the respondents had to verify that they currently taught at least one course of middle school math and were then asked to select the grades taught. When prompted to answer
the grade level question, 6 respondents closed the survey, leaving the data to examine for 46 respondents.

Interview

Participants in this study were asked directly by the researcher to participate in the study after willingly volunteering on the last question of the survey questionnaire. There were no negative consequences or personal resentment from the researcher if a participant chose not to participate. The sample size consisted of four teachers that teach middle school math at school districts in Oklahoma. The smaller sample size was appropriate for a qualitative research study. Details regarding the specific selection of the interview participants is described in the Data Collection section below.

Theoretical Framework

This research employed Design Theory to better understand the cognitive planning processes that teachers engage in while developing assessments for students. The theory was derived by the work of Simon (1996) when finding a way to define the design of problem-solving. According to Simon (1996), design is integral to all professional training and as such, everyone designs when they “devises courses of action aiming at changing existing situations into preferred ones (p. 111). There are several theoretical approaches that assist in understanding, explaining and describing knowledge and practice that live under the Design Theory umbrella. Research by Hatchuel (2001) used the term, “learning-devices” which are processes to find solutions, or in better terms “to learn about what has to be learned or could be learned” (p.266). In a classroom, this is a daily occurrence through formative and summative assessments.
Although there have been few studies that employed Design Theory in an educational setting, there appears to be a clear alignment. When creating assessments, teachers are using creativity to derive what is currently known by students and how to progress forward with that information. They are inadvertently using the “learning-devices” that Hatchuel (2001) spoke of, and they are ultimately using a design process every day of their career. “When we study the process of design, we discover that design is problem-solving. If you have a basic theory of problem-solving then you are well on your way to a theory of Design” (Simon, 1989, p.390).

In order to narrow down the wide array of constructs of engagement in education, Appleton et al. (2006) defined engagement as a “multidimensional construct comprised of four subtypes, which include academic, behavioral, cognitive, and psychological” (p. 429). These indicators and outcomes are reflected in Figure 2. Borup et al. (2014) added a fourth construct, parent engagement, to target the adolescent student engagement and the impact it has on the overall academic success.
**Figure 2**

*Engagement subtypes, indicators, and outcomes.*

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**Data Collection**

Data for this dissertation was collected using two methods: a survey and interviews. The original purpose of the survey was to use as a screener to identify the demographic and experiences of the participants and their interest in a follow-up interview. While analyzing data, the researcher decided that questions on the survey could impact the research and chose to use the results from a select number of survey questions. This data can be found in the following chapter.

*Survey*
An online survey was emailed to middle school math teachers in Oklahoma (see Appendix C for survey). A survey was used to collect data to understand teacher experiences, perceptions, and use of technology in a middle school math classroom. The researcher used a validated survey instrument titled Computer-Based Formative Assessment Survey created by Sullivan et al. (2021). The researcher removed questions one and two from the original instrument because they focused specifically on advanced and collaborative classes and this study was not targeting a specific ability level but rather general math classes. The researcher validated the instrument by running a Cronbach Alpha Reliability test in SPSS. The value for Cronbach’s Alpha for the survey was $\alpha = .901$, concluding the reliability level of the survey is excellent. The original intent of the survey was to find participants willing to participate in a follow-up interview. This survey was chosen due to its wide array of questions focusing on four areas of computer-based assessments in a classroom: comfort with technology, teacher autonomy, perceived benefit in using technology in the classroom, and technology vision and support. The researcher was able to use the data from the survey to confirm the participants had autonomy to create unique online assessments, as well as find diversity in the professional learning opportunities presented to them. Upon receiving the data from the survey, the researcher determined that it would largely benefit this study to include survey results because of the large amount of data collected.

The researcher emailed the link to a survey questionnaire to the entire population of middle school math teachers in Oklahoma, as reported by the Oklahoma State Department of Education website. To obtain this information, the researcher downloaded an Excel spreadsheet labeled ‘FY24 Certified Salary Report for Public Website’ from the
Oklahoma State Department of Education website. The researcher used filters in Excel to only include ‘MATHEMATICS’ in Column Q, Subject Description, which left the spreadsheet with 2,548 records. After filtering for mathematics, the researcher used a filter in Column H, School Name, to exclude all schools including HS, ES, High and Elementary in their title. This filtered the spreadsheet to 350 records. The survey was also posted on two social media platforms, Facebook and X, and sent to the department heads of mathematics in eight school districts with a request to forward to the middle school math teachers in their district. The survey was open for two weeks. Overall, 46 teachers completed the survey. The respondents included 43 females and three males. Upon the closure of the survey, the researcher looked through the results of the survey and sorted the data by participants that stated they would be willing to participate in a follow-up interview.

**Interview**

The second phase of the research identified willing participants from the survey to interview using follow-up questions specific to the design process they use when creating online assessments and the key considerations and specific strategies they integrate into the assessments. The last question of the online survey asked participants if they would like to participate in a follow up interview that would be conducted online. Of the 46 survey participants, 35 selected they would be willing to participate in the interview.

The researcher initially emailed six participants that indicated their willingness to participate in the voluntary follow-up interview. The limited number of interview participants was deemed suitable for a qualitative research sample, aiming to “provide in-depth information about the central phenomenon or concept” (Creswell & Plano Clark,
The individuals were selected based on a variety of factors to include years of experience, type of school district, teacher autonomy to create assessments, and availability of resources and training. For this study, it was very important that the chosen participants had indicated on the survey that they had autonomy to create their own assessments. To select potential interview participants from the survey respondents who were willing to participate in an interview, the researcher had to decide if the study would focus on the diversity of teacher demographics or school setting. Ultimately, the researcher decided to focus this study on the diversity of school settings, including socio-economic status, the location within the state, and the availability of resources and training. Of the six emailed participants, four were willing to schedule a follow-up interview. One of the two survey respondents that declined a follow-up interview was the only male teacher asked to participate and had less than five years of teaching experience. The second survey respondent that declined a follow-up interview was a teacher with less than 10 years of experience. The researcher emailed the two nonrespondent survey participants one additional time requesting their participation in a follow-up interview and did not receive a reply from either participant. The four participants selected for the follow-up interview represented the greatest diversity in school settings, although each of the participants was female. The majority of middle school math teacher positions are held by females (75%), as reported by the Oklahoma State Department of Education and shown in Figure 3.
Figure 3

*Gender Percentages of Middle School Math Teachers in Oklahoma*

![Pie chart showing gender percentages of middle school math teachers in Oklahoma.]

Note. Demographics obtained from publicly available data on the Oklahoma State Department of Education website. Researcher filtered for middle school math teachers.

The follow-up interview used semi-structured questions (see appendix D) which were constructed using Flanagan’s (1954) Critical Incident Technique (CIT). The CIT investigates behavior of a person and how the fulfillment of educational purposes is impacted by a specific behavior (Corbally, 1956). There are five key stages of CIT: general aims, plans, and specifications; collecting the data; analyzing the data; and interpreting and reporting the data (Radford, 2006). Radford (2006) explains how conducting an interview in person or by phone (online meeting room) is much more labor-intensive than sending a survey to someone. Question stems when using the Critical Incident Technique might include phrases such as “What do you remember about that?” or “Please tell me more about how that made you feel.” It is important to note that using this technique will not necessarily give the researcher a general aim, as all stakeholders
may view the general aim differently, but that the general aim is acceptable by the potential users (Flanagan, 1954). An interview guide with prompts related to student engagement during online assessments was constructed prior to the interview along with generic CIT question stems to help guide the researcher.

The semi-structured interview questions were approved by the Oklahoma State University IRB. The interviews were conducted virtually using Google Meet, which provided a video recording and transcription at the end of each interview. The participants signed a consent form prior to being recorded that they agreed to be recorded and the conversation could be transcribed and used in this research as well as future research if applicable. The transcription from each interview was automatically placed into a Google Drive folder at the conclusion of each interview. The researcher immediately changed the name of the participant to the pseudonym used for that specific participant. The file was then downloaded to a password protected flash drive. The transcriptions were validated by the participants through email. The researcher sent a copy of the document using the titles “researcher” and “participant” in lieu of real names and asked if the transcription was an accurate recording of the virtual interview. Each participant replied that the interviews were transcribed accurately.

**Data Analysis**

To prepare for the qualitative data analysis, the transcription data from the interviews were pulled from the automatic location they were placed in Google Drive and were then read by the researcher to check for accuracy. To accomplish member check, the participants were emailed a transcript of their interview and asked if it was an accurate transcription. Lincoln and Guba (1985) have argued that member checking is an
important step in the qualitative research process because by sending participants their
data it allows them to verify if what is transcribed is true and represents what they meant
to say. All participants responded to affirm the transcriptions were correct. For this
study, the analysis involved coding to conduct a thematic analysis.

Coding

After collecting the data, transcribing, and member checking, the research began
the six-phase coding process. Coding, in its simplest level, involves recognizing
meaningful segments within research data and assigning labels or codes to them
(Linneberg & Korsgaard, 2019).

The coding for this dissertation included the four interviews with middle school
math teachers in the state of Oklahoma. After receiving the email verification from each
participant that confirmed their interview transcription was accurate, the researcher did an
initial read through of each of the interviews to get a general feel of what appeared to be
important. On the second reading of the interview transcripts, the researcher underlined
key words and phrases, and highlighting commonalities within each individual interview
while making notes on a sheet of paper. This second reading was completed with an
open-mind by the researcher and there were no pre-determined themes that the researcher
was hopeful to find prior to creating the codes. The researcher used a free-coding
approach to eliminate bias and began to generate initial codes in the margins of the
transcriptions. The researcher read the transcripts a third time to ensure no data was
missed and that all codes were generated. Twenty-one codes were created from the
transcriptions of the interviews. For the next phase, the researcher sorted the different
codes into related groups on a sheet of paper to form categories as guided by Braun &
Clarke’s (2006) process. The categories were then grouped together to form overarching themes. This process led to six overarching themes. The described process is reflected in Table 2

Moving From Codes to Categories to Themes

Table 2

<table>
<thead>
<tr>
<th>Codes</th>
<th>Categories</th>
<th>Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple students need read aloud</td>
<td>Challenges when creating assessments to align with IEPs</td>
<td>Teachers consider the diverse needs of students when creating online assessments for math.</td>
</tr>
<tr>
<td>Difficulty with IEP assessments</td>
<td>Provide enrichment opportunities for students</td>
<td></td>
</tr>
<tr>
<td>Skill level of students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Available resources</td>
<td>Prioritizing Factors</td>
<td>Technology is integrated for reinforcing strategies across a variety of available platforms.</td>
</tr>
<tr>
<td>Reteach skills</td>
<td>Variety of assessment techniques</td>
<td></td>
</tr>
<tr>
<td>Teacher efficiency for grading</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keeping students engaged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online quizzes</td>
<td>Incorporating technology</td>
<td>A variety of strategies and technology tools are incorporated into online math assessments to provide differentiated opportunities for all learners in a classroom.</td>
</tr>
<tr>
<td>Premade content for efficiency</td>
<td>Premade assessments are used to increase teacher efficiency</td>
<td></td>
</tr>
<tr>
<td>Recording and pictures</td>
<td>Students submit recordings and pictures of their work when applicable</td>
<td></td>
</tr>
<tr>
<td>Variation with types of questions available for assessments through the LMS</td>
<td>Easy to incorporate a variety of question types in an LMS</td>
<td>A variety of assessment types and the use of a learning management system (LMS) are common approaches teachers use when creating online math assessments.</td>
</tr>
<tr>
<td>LMS is easy to use</td>
<td>Teachers experience increased efficiency over time using an LMS because of automatic rostering and grade syncing</td>
<td></td>
</tr>
<tr>
<td>Automatically rosters students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grades sync atomically to gradebook</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explicit instructions</td>
<td>Design considerations for navigating online assessments</td>
<td>Student engagement during online math assessments can be influenced by the design features embedded in the assessment and the level of familiarity with the online tools and formats.</td>
</tr>
<tr>
<td>Technology comfortability for students</td>
<td>Students need clear and direct instructions throughout the assessments</td>
<td></td>
</tr>
<tr>
<td>Easy to navigate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students left device at home</td>
<td>Overcoming connectivity challenges</td>
<td>Technical issues and limitations often interfere with student engagement when taking an online math assessment.</td>
</tr>
<tr>
<td>Lack of reliability with technology</td>
<td>Students forget to charge and bring device to school</td>
<td></td>
</tr>
<tr>
<td>A few students cannot access the assessment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The researcher sent the transcripts, codes, and overarching themes to three peers to review the process. One peer reviewer recommended the researcher use ATLAS.ti
software, a qualitative data analysis tool, to reconcile the coding found on that software to coding identified during the initial analysis to reconcile any codes that could have been missed during the coding phase. The researcher uploaded the transcriptions into ATLAS.ti to perform an inductive analysis of the data. The researcher free-coded the data through this program to ensure all codes were captured. The report produced by ATLAS.ti matched almost identically to the overarching themes the researcher found during the manual coding process and was able to confirm the themes were a direct reflection of the codes found in the data.

The major qualitative data findings are summarized in Chapter IV and described in detail along with direct quotes from the participants. The findings are related to past research and findings and provide implications on how this study can impact future research studies.

**Thematic Analysis**

The thematic analysis approach from the work of Braun and Clarke (2006) was applied to help analyze, identify, and find the repeated patterns found in the interview data to represent the research questions. Braun and Clarke’s (2006) thematic analysis uses key conceptual foundations in a six-phase process that include familiarization with the data, coding, searching for themes, reviewing themes, defining and naming themes, and writing up. For the first phase of analyzing data for this study, the researcher read through the interview transcripts two times while highlighting and making analytical notes in the margins. For the second step of the process, the researcher began to find initial codes by reading back through the transcriptions and the margin notes to begin seeing patterns of words and phrases that were used repeatedly through each of the
interviews. During this phase, the researcher also looked for text that addressed the research questions specifically. Once the codes were determined, the researcher read back through the transcriptions and used a color-coded highlighting method to associate a specific code with the relevant data found. It was important that the researcher did not use the research questions themselves to generate themes, as that is not an accurate analyzation (Braun & Clarke, 2006). Phases four and five were completed almost simultaneously as the researcher wanted to ensure there was a clear alignment. The codes and transcriptions were then sent to peer reviewers to ensure there was sufficient data to support the coding and developing themes. The final phase of the six-phase process is to inform the reader of the information obtained from the participants and ensure it is a true representation as “the themes should form a coherent overall “story” about the data, presented in the order that best tells the overall story” (Braun & Clarke, 2006). Figure 4 was created by the researcher to effectively communicate and to visually represent this six-phase process.
Figure 4

*Interactive Phases of a Thematic Analysis Flowchart.*

Note. This flowchart illustrates the process the researcher used for reviewing and revising themes for a social work case study and is an adaption from *Thematic analysis in social work: A case study.* Labra, O., et. al, 2022, which was created to illustrate Braun & Clarke’s (2006) Six-Phase Process.

**Methodological Limitations**

The amount of accessible data available to the researcher was dependent on the number of teachers that selected to participate in the interview and the years of experience they had in the classroom, as well as their perceptions, and overall understanding of online assessments. There were 46 respondents to the survey and the researcher reached out to six (13%) of the respondents to request their participation in a follow up interview and four of the selected respondents agreed to participate. A longitudinal study that assessed teacher burnout through one entire school year found that the three trajectories that affect teacher burnout are physical fatigue, cognitive weariness, and emotional exhaustion (Cece et al., 2022, p. 601). While the authors did not find a true pattern in the time of year the burnouts happen, they did recognize that teachers
could experience burnout more than once during a school year (Cece et al., 2022). With this information, it is important to understand the teachers’ responses could have been more vague than usual. The small number of interview participants and the possibility of vague answering to the interview questions could have posed limits that kept the researcher from collecting more data, and thus finding more in-depth themes.

**Ethical Considerations**

For this study, the researcher did not begin data collection until IRB approval was received from Oklahoma State University. The interviews with Oklahoma middle school math teachers were conducted on a voluntary basis. The participants received a twenty-five dollar Amazon gift card, sent through email, upon their completion of the interview. Creswell and Plano Clark (2017) justified the use of an incentive to “help recruit individuals and sites, as can the provision of engaging materials that provide information about how the study results will benefit the groups participating in the project” (p. 179). There was no negative consequence or repercussions for unwilling participants. The participants’ names and schools were collected during the interview and the information was placed, and remains, in a password-protected file for 3 years. The volunteer interview participants have a pseudonym that is associated with their names that protected their privacy for the entirety of the study, as the researcher was, and is, the only person with access to the file. The passkey containing the participants and their unique code is stored, along with the participant emails, in a password-protected file.

Informed consent was provided to all four interview participants which notified them of the purpose of the study, the procedures, and the benefits of the study. Considerations for confidentiality were evaluated during each step of the research
to ensure the privacy of the participants and the data collected remained confidential. No risks were associated with this study and all participants were over the age of 18. The contact information for the researcher and the researcher’s graduate advisor were included in the email communication to address any further questions the participants may have needed to seek clarification on.

**Researcher Subjectivities**

The researcher has a background of teaching middle school math in a school district that utilized a learning management system (LMS), which she used daily for her students. The assignments in the class were assigned through the LMS, and students were responsible for completing the assignments. All assessments for this middle school math class were also completed online. It was important that the researcher did not bring any personal bias into this study due to the experience she has with online assessments, although her background knowledge and expertise were used to provide guidance with the semi-structured interviews.

**Trustworthiness**

Credibility, transferability, dependability, and confirmability are the elements that Lincoln and Guba (1985) used to describe the trustworthiness of the validity and reliability in a qualitative research study. Castleberry and Nolen (2018) describe these four elements as the criteria used to hold all qualitative studies to a high standard. The researcher established trustworthiness in each of the six-phases of Braun & Clarke’s (2006) process. For phases one and five, the researcher documented memos and kept records of all transcripts and memos in a well-organized folder (Nowell et al., 2017). Inductive coding was used in phase two to establish trustworthiness. To establish
trustworthiness in phase three, the researcher kept a detailed record of notes for the progression of themes. During the fourth phase, trustworthiness was established by asking peer reviewers to review the themes and to provide feedback to improve the final themes. For the sixth and final phase, the researcher established trustworthiness by providing “thick descriptions” so the readers have text available to them that are very rich in details about the interviews for the reader to have a sense that they were there during the interview (Geertz, 1973).

The semi-structured interview questions were constructed using CIT (Flanagan, 1954) to drive the interview (see Appendix D). The five steps of CIT are review incidents, collect facts, analyze data, determine outcomes, and evaluate the solution. The researcher used the techniques included in CIT when considering follow-up questions during the interviews. In qualitative research, it is important that a researcher is able to “access the thoughts and feelings of research participants” to facilitate the development of comprehension regarding significance in which people attribute their experiences (Sutton & Austin, 2015, p.1).

Summary

Chapter III provided details on the research design, method, thematic analysis, and procedures used in this study. The purpose of the study was stated at the start of the chapter, along with the epistemological perspective used to guide this research. This qualitative study explores the connection between the perception K12 teachers have on student engagement with online assessments and the overall impact online assessments have on student engagement and learning. This chapter also includes the selection process for the participants as well as the instruments used for observations.
CHAPTER IV

FINDINGS

Introduction

This qualitative study uses a design theory theoretical lens to examine and understand the training, design, and implementation teachers use in a middle school classroom to create and administer engaging online math assessments to students. This chapter presents the findings of the study conducted in three parts. First, it provides the data obtained through the online survey. Second, it outlines the criteria used in selecting the four participants whose responses underwent coding and analysis. Lastly, the findings are presented with the research questions associated with the themes that were developed when analyzing the data.

Survey

The initial data collection for this dissertation study was a survey instrument administered to middle school math teachers. The figures below present demographics of the survey participants.
Figure 5 presents the participants’ number of years teaching. Out of the 46 responses, 46 participants (100%) answered this question.
The number of years teaching in both the 1-5 Years and the 6-10 Years was an identical number. The largest teaching experience group were respondents with more than 11 years of teaching experience, which represents 44% of the respondents.

Figure 6 shows the grade level currently taught by the 46 respondents that chose to answer this demographic question. Of the 46 responses, 15 currently teach sixth grade (32%), seventh and eighth grades both had 11 respondents each from their grade (24%).
When survey respondents were asked if they had been provided any opportunities for professional development in the last 12 months (see Figure 7), 32 (71%) selected yes, and 13 (29%) responded no. When responding to the opportunity to attend professional development for instructional technology, 33 (33%) responded yes, and 12 (27%) responded no.

**Figure 7**

*Professional Development Opportunities (N=46)*

When survey respondents were asked if they had been provided any collaboration opportunities with teachers for using assessments for professional development in the last 30 days (Figure 8), 40 (89%) selected yes, and 5 (11%) responded no. When responding to the opportunity to collaborate with teachers for using instructional technology, 36 (80%) responded yes and 9 (20%) responded no. These results are shown in Figure 8.

**Figure 8**

*Collaboration Opportunities (N=45)*
Survey respondents were asked questions to determine their overall comfort with technology use in their classrooms. The results of the data are organized in Table 3. All the respondents indicated they are comfortable with their ability to work with instructional technology in their classroom while 20% indicated that learning new technology is confusing for them. 47% of respondents answered they become anxious using technology in their classroom because they are unsure what to do if something goes wrong, while only 25% indicated they are not confident in their ability to troubleshoot technology issues if they arise.
Table 3

*Comfort with Technology (N=44)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel comfortable with my ability to work with instructional technologies.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>25</td>
<td>57</td>
</tr>
<tr>
<td>Agree</td>
<td>19</td>
<td>43</td>
</tr>
<tr>
<td>Disagree</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Learning new technologies is confusing for me.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Agree</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>Disagree</td>
<td>21</td>
<td>48</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>14</td>
<td>32</td>
</tr>
<tr>
<td>I get excited when I am able to show my students a new technology or tool.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>21</td>
<td>48</td>
</tr>
<tr>
<td>Agree</td>
<td>19</td>
<td>43</td>
</tr>
<tr>
<td>Disagree</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>I enjoy finding new ways my students and I can use technology in the classroom.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>20</td>
<td>46</td>
</tr>
<tr>
<td>Agree</td>
<td>19</td>
<td>43</td>
</tr>
<tr>
<td>Disagree</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I get anxious when using new technologies because I may not know what to do if something goes wrong.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Agree</td>
<td>16</td>
<td>36</td>
</tr>
<tr>
<td>Disagree</td>
<td>14</td>
<td>32</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>I am confident in my ability to troubleshoot when problems arise while using technology.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>15</td>
<td>34</td>
</tr>
<tr>
<td>Agree</td>
<td>18</td>
<td>41</td>
</tr>
<tr>
<td>Disagree</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Learning new technologies that I can use in the classroom is important to me.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>19</td>
<td>43</td>
</tr>
<tr>
<td>Agree</td>
<td>20</td>
<td>46</td>
</tr>
<tr>
<td>Disagree</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I am confident in trying to learn new technologies on my own.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>14</td>
<td>32</td>
</tr>
<tr>
<td>Agree</td>
<td>22</td>
<td>50</td>
</tr>
<tr>
<td>Disagree</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

When teachers were asked about the autonomy they have when creating assessments and content, less than 12% admitted to not being able to select or create their own assessments. Table 4 further shows that 14% of respondents indicated they are
unable to use technology in their classroom as they want but must follow specific
guidelines from their school district.

**Table 4**

*Teacher Autonomy (N=43)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am able to select assessments for my students on my own.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>23</td>
<td>53</td>
</tr>
<tr>
<td>Agree</td>
<td>17</td>
<td>40</td>
</tr>
<tr>
<td>Disagree</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>I have the freedom to design and prepare assessments in my own way.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>24</td>
<td>56</td>
</tr>
<tr>
<td>Agree</td>
<td>14</td>
<td>33</td>
</tr>
<tr>
<td>Disagree</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>I am allowed to assess students in a manner that I want. (modality)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>23</td>
<td>53</td>
</tr>
<tr>
<td>Agree</td>
<td>14</td>
<td>33</td>
</tr>
<tr>
<td>Disagree</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>I have the freedom to use mobile devices and other technology in a flexible way in my lesson.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>15</td>
<td>35</td>
</tr>
<tr>
<td>Agree</td>
<td>22</td>
<td>51</td>
</tr>
<tr>
<td>Disagree</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

The teachers that responded to the survey were asked to share their perceptions when using technology for learning in their math classes, shown in
Eighty percent of respondents specified technology allows them to enhance the learning experience when creating assessments and 89% indicated that technology helps them better organize their classrooms. Thirty percent of teachers observed that their students are not engaged while taking online assessments, while every teacher believes technology can be an effective learning tool for students.
Table 5

Perceived Benefit in Using Technology in the Classroom (N=44)

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer technology allows me to create assessments that enhance the learning experience.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>17</td>
<td>39</td>
</tr>
<tr>
<td>Agree</td>
<td>18</td>
<td>41</td>
</tr>
<tr>
<td>Disagree</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Computer technologies help me be better organized in my classroom.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>17</td>
<td>39</td>
</tr>
<tr>
<td>Agree</td>
<td>22</td>
<td>50</td>
</tr>
<tr>
<td>Disagree</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>My students get excited when they use technology in the learning process.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>13</td>
<td>29</td>
</tr>
<tr>
<td>Agree</td>
<td>24</td>
<td>55</td>
</tr>
<tr>
<td>Disagree</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>My students are engaged with taking assessments online.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>Agree</td>
<td>23</td>
<td>52</td>
</tr>
<tr>
<td>Disagree</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Technology can be an effective learning tool for students.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>17</td>
<td>39</td>
</tr>
<tr>
<td>Agree</td>
<td>27</td>
<td>61</td>
</tr>
<tr>
<td>Disagree</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The survey data, shown in Table 6, reported that 71% of the respondents’ schools have clearly communicated a vision for technology with the faculty and the same percentage responded that curriculum support is available in their building to assist with technology integration, while 89% shared that technology support is available in their building to assist with troubleshooting.
### Table 6

**Technology Vision and Support (N=44)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A vision for technology use in our school is clearly communicated with faculty.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>14</td>
<td>32</td>
</tr>
<tr>
<td>Agree</td>
<td>17</td>
<td>39</td>
</tr>
<tr>
<td>Disagree</td>
<td>13</td>
<td>29</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Curriculum support is available in my building to assist with technology integration ideas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>14</td>
<td>32</td>
</tr>
<tr>
<td>Agree</td>
<td>17</td>
<td>39</td>
</tr>
<tr>
<td>Disagree</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>My building principal encourages faculty to integrate technology in the classroom.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>17</td>
<td>39</td>
</tr>
<tr>
<td>Agree</td>
<td>21</td>
<td>48</td>
</tr>
<tr>
<td>Disagree</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Technology support is available in my building to assist with troubleshooting.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>12</td>
<td>27</td>
</tr>
<tr>
<td>Agree</td>
<td>27</td>
<td>62</td>
</tr>
<tr>
<td>Disagree</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>My colleagues are committed to integrating technology in the classroom.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>11</td>
<td>25</td>
</tr>
<tr>
<td>Agree</td>
<td>29</td>
<td>66</td>
</tr>
<tr>
<td>Disagree</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

**Summary of Survey Findings**

The survey provided a great quantity of background data for the participants, as well as the current conditions with using technology in the 46 math classrooms the survey respondents are in. This data reflects that the survey respondents all felt comfortable with using technology in their classrooms, however not all of them feel confident in trying out new technology. By looking at the data from the survey, it is apparent that teachers enjoy finding ways to incorporate technology in their classrooms, although learning the new technologies has been confusing for 20% of the respondents. There appears to be some inequities in training opportunities around the state that are centered on instructional technology because the survey results showed that 27% of survey
respondents had not received this type of training in over a year. While the majority of respondents indicated they had autonomy to create assessments for their own classrooms, there are still some teachers that are unable to complete this task.

**Interviews**

*Criteria for Analysis of Selected Participants*

Four participants provided their experiences for this study and their interview transcripts underwent coding and analysis. To maintain complete anonymity, pseudonyms have been used in place of the teachers’ real names. After reviewing the transcripts and initial codes, the researcher confirmed all four participants interviewed met the following criteria:

- Taught at least one math class in a middle school in Oklahoma
- Had the autonomy to create their own assessment
- Were provided with opportunities for resources and training for assessments

The following provides a description of each of the four participants who met the criteria listed above and were analyzed using Braun & Clarke’s (2006) thematic analysis.

**Description of Participants**

*Mrs. Paneratea*

Mrs. Paneratea is a veteran teacher of thirty-two years. She recently transitioned to middle school math two years ago from an elementary school within the same suburban public school district in the central part of Oklahoma. She currently serves on the textbook adoption committee for her district and has completed multiple trainings and workshops on effective coaching cycles, which she attributes to her success in self-reflection and content creation in her classroom. She eagerly attends all professional
development opportunities presented by her district and her state department of education to collaborate with teachers around the state to ensure she is staying up with current research and trends in middle school mathematics. She indicated on the survey that she has been provided professional development on the use of assessments in the past 12 months but has not been provided any training or professional development on the use of instructional technology in her classroom. During the interview she shared that she has joined multiple math groups on her Facebook account and watches videos to better incorporate technology into her lessons and to increase the level of engagement for her students. She also stated that the Facebook groups are a collaborative way for her to communicate with educators across the nation on effective and engaging math practices to use in their middle school classrooms.

Mrs. Paneratea also indicated on the survey that she is very comfortable in using technology in her classroom and that learning technology is not confusing for her. She enthusiastically shared during the interview that she enjoys finding new ways to use technology in her classroom and gets excited when she has new technology to use for her students. Although Mrs. Paneratea expressed on the survey that she incorporates technology daily in her classroom, she is not confident in her ability to troubleshoot technology issues when they arise. She also revealed in the survey that she does have autonomy when deciding what assessments look like in her classroom, although she is cognizant of her district’s expectations and follows their directives, specifically the pacing calendars. During the interview, she shared that she does create math assessments for her students to determine their understanding of each concept she teaches as she does not feel the district provides these assessments as in-depth as she prefers. During the
interview, Mrs. Paneratea shared at different times that the assessments she gives the students are not “just for a grade” but to “truly understand what is being taught to them” so she can reteach or provide individualized instructions to students that may be struggling with a concept.

On the survey, Mrs. Paneratea also indicated that using technology helps her stay better organized in her classroom, which she also discussed in depth during the interview when talking about automatic grading and that student grades since automatically with the gradebook. She eagerly shared that her move from an elementary classroom to a middle school classroom gave her a lot more personal time at home because she was not having to take papers home to grade when she left work each day. Mrs. Paneratea did not originally agree on the survey that her students were engaged while taking online math assessments, however during the interview she shared many examples of her students “having fun” and “not knowing they were taking a test” because they were engaged during computer-based assessments.

Mrs. Paneratea is fully supported by the administration at her school to provide any resource she deems as appropriate to teach student the math concepts she is required to teach. During the interview, she shared that her principal does require the teachers to upload their weekly common formative assessments but that she has never been told to use other resources because her assessments provide an abundance of data for making decisions in her classroom.

Mrs. Carlisle

Mrs. Carlisle has been a public-school teacher for 19 years. She taught at multiple public schools around the central part of Oklahoma for the first half of her career and is
now a teacher for a charter school that follows a hybrid schedule. Although she teaches more subjects than math, she understood the answers in the interview should only reflect her current math courses. She was a former teacher of the year for a previous school and has attended countless trainings for assessments, both creation and the use of. She presented herself as very knowledgeable about assessments and even shared that she contracted with a national company to create test questions specific to state learning standards. Mrs. Carlisle expressed on the survey that technology use is a large part of her teaching in the current hybrid model and provided many platforms that are used weekly in her courses, such as Delta Math, Mastery Connect, IXL, and the quiz features in Canvas.

Mrs. Carlisle also indicated on her survey that she has not been provided any professional development or training opportunities for instructional technology by her district in the past 12 months, although she has been provided with professional development opportunities for assessing students. During the interview, the researcher asked Mrs. Carlisle to explain the professional development opportunities and she discussed that the sessions were not for teachers to learn how to create assessments, but rather how to look at assessment data to make educated decisions for the students that she teaches each day. On the survey, Mrs. Carlisle indicated that she does not get anxious when using new technologies because she is comfortable with troubleshooting issues when they arise and laughed when she said, “it would be a difficult job to teach in a hybrid model and stress out each time something broke with technology.”

Although she does have some autonomy to create online assessments, she shared that her district has a large number of required assessments that students must take. She
said she tries to keep an equal balance of “fun and engaged learning” while also having students complete the assessments required by her district. When she needs to do a quick check for student understanding she shared that she will create a quick Nearpod or Kahoot so the students are engaged and having fun while she checks for understanding. During the interview, her excitement for teaching was evident in the way she responded to each question and the amount of energy she had while answering questions. She said she was nervous to move from a traditional school model of being in a classroom each day to teaching students on a hybrid schedule but that it has “definitely paid off when I see the students that struggled with staying engaged in school and had failing grades move to this hybrid model and begin to excel”.

Mrs. Obi

Mrs. Obi is a veteran teacher at a private school in the northeastern part of Oklahoma. She has been teaching for more than 20 years in both public and private schools. She currently teaches sixth-grade math, one course of seventh-grade math, and honors algebra at her middle school, along with technology courses. She holds a master’s degree in mathematics education and leads her schools’ math vertical collaborations. She is also a National Board-Certified teacher. Mrs. Obi shared many times throughout the interview how she has the autonomy to create any type of assignment or assessment for her students because she does teach in a smaller private school. She said many times throughout the interview that her principal does not care how she teaches because “he walks through and sees the students engaged and sees how well they perform on their assessments”. Mrs. Obi was not very outgoing during the interview, and the researcher had to ask her to repeat what she said twice because she spoke softly. She remained very
relaxed and easygoing during the entire interview and did not show much emotion. Her survey responses indicated that she has complete autonomy to create the content and assessments needed for her students without district oversight. She also expressed on the survey that the students do not always seem engaged when completing math assessments online. During the interview she spoke about her preference for assessments to be taken on paper and pencil because students seem to perform better. When the researcher asked her why she thought that was, she said, “they have the paper in front of them and do not have to look at the screen, then write on the paper, then back to the screen; it is all right here in front of them already written on the paper.” Although she continued to reference paper and pencil assessments, she did share that she really likes that graphing calculators are available online for students when taking online assessments.

Mrs. Obi did speak negatively about the internet connectivity at her school. She said the school has spent a lot of money to ensure there are no issues with technology but that she experiences issues intermittently and cannot ever fully depend on it to work. She continued by saying that if she prints the assessment on paper then she will not have that issues. However, she does not want her thoughts of unreliable technology to interfere with her students receiving instruction that has a “healthy balance of technology” and continues to use it daily in her classroom. She said she has really started using the quiz feature in IXL and that students seem very engaged when working the problems in that program. She continued to reference the IXL quizzes throughout the interview in a way that informed the researcher that is the one piece of technology she uses consistently in her classroom, along with the use of Desmos.

*Ms. Bennett*
Ms. Bennett is a middle school math teacher in a rural school district in the southeast region of Oklahoma. She has been teaching for six years and currently teaches fifth grade math to 60 students every day in the district middle school. Her survey responses indicated that there is a lack of technology availability to use when teaching math, but she also has a desire to use more technology in her classroom. Ms. Bennett shared that she wants her students to be able to take the devices home because of the ways she sees teachers using a “watered-down model of a flipped classroom” on collaborative spaces she engages in online, but that she only has one cart of Chromebooks in her classroom that the students share. Ms. Bennett uses online math programs, such as IXL and Prodigy Math, to review content before taking assessments. She has attempted to convert her district required assessments to an online format using Google Classroom a few times but does not feel supported by her administration or colleagues because they do not see how “using technology is conducive to learning”. She seemed disheartened that she is unable to implement technology in her classroom on a large scale like she wants, but is hopeful that her administrators will see the positive effects it has for student learning.

Ms. Bennett was very positive when discussing technology use in her classroom while interviewing her and the researcher could tell by her facial expressions that she was disappointed with the lack of support she receives. She did discuss how it makes teaching easier because the quizzes she creates in Google Forms can grade automatically, although she still has to input the grades by hand into the gradebook because her district has not setup the programs to sync automatically. She said there are only two people in her district that work in technology and that neither of them have classroom experience
so they do not fully understand the needs she has as a teacher. She indicated on the survey that she has not received any district provided training or professional development on instructional technology because there is no one in the technology department to train the teachers. She also shared that there is no one to answer instructional specific questions related to technology when she has one. Although she has many barriers to fully implementing technology in her classroom like she would like, that does not stop her from finding ways to use it. She shared that she is constantly online trying to find new ideas to try with her students because she can see how engaged the students are when they are using their Chromebooks for learning.

Findings

This section provides the outcomes of the research highlighting how participants’ experiences guide them when creating online math assessments, the benefits and challenges they observe when students are taking online math assessments, and how they perceive student engagement when taking math assessments online. The study’s themes were developed using the Braun & Clarke (2006) thematic analysis approach and validated for trustworthiness using mentor checking and written memos throughout (Stahl & King, 2020). The qualitative study enabled a thorough examination of the thoughts, viewpoints, and experiences of the four participants selected based on purposive sampling criteria. It is also important to note that the direct quotes from participants are formatted in an italicized block quote to limit confusion for the reader.

Theme One: Teachers must consider the diverse needs of students when creating online assessments for math.
The data that produced this theme derived from interview question two: *Can you describe the key considerations, including the level of question difficulty, when designing online math assessments for engagement?*

The participants in this study discussed the diverse needs of the students in their classrooms and the need to follow accommodations for students on an Individualized Education Program (IEP), which are educational plans developed for students with special needs, as well as to provide enrichment opportunities for advanced students. Mrs. Paneratea shared that,

*I have to consider how many children I have in my classroom that have to have a text-to-speech option and how many students must have a shortened assignment. These are things that I have to consider now that I didn’t have to consider 15 years ago. In order to engage students with learning disabilities, it is important they are met on their level of instruction and provided opportunities they can excel in.*

Mrs. Carlisle shared,

*I have to always take the students’ needs into complete consideration when creating all assignments and assessments because I teach students across a wide range, including students on IEPs as well as students that have been labeled as gifted and talented students. Sometimes I make one blanket assessment and then duplicate it multiple times so that it can be personalized to include the variety of modifications and accommodations that are written into the IEPs.*

Mrs. Obi shared that the online assessments she creates,
are written with the students’ skill level in mind and typically only available for skills that do not require a lot of work to be solved but more simple questions.

She gave an example that if students are combining coefficients or multiplying integers that she typically creates an online version to quickly assess their level of knowledge but prefers to give a paper and pencil test if they will be completing standards that involve multi-step equations or creating a parabolic graph. Ms. Bennett shared that she creates 99% of her assessments to be administered online because of the immediate feedback it provides students.

She also stated that she spends the first few weeks of school working through online assignments and assessments with the students so they are not being graded on the ability to use the technology but that the online assessments provide a true reflection of what the students know.

Theme Two: Technology is integrated for reinforcing strategies across a variety of available platforms.

The data that led to this theme derived from interview question 5: Can you provide examples of specific strategies or features that you include to make online math assessments more engaging for students?

Each of the participants spoke about the use of technology to reteach skills to the students in their classes. Mrs. Panerata shared,
Students do not know how to work math problems out on paper, so they must first be taught how to look at the math problem on the screen and write it verbatim on a sheet of paper. The problem is noticeable when students must look at the board in the room, or their Chromebook screens, and then copy the problem down on their own paper as they get confused or miss vital parts of the problem.

Mrs. Paneratea also shared that before she ever has a student begin working on an assessment that she instructs the students to get out a sheet of notebook paper, a calculator, and a pencil and has them number their paper with the number of questions on the assessment. Mrs. Carlisle shared that she uses all types of media in her lessons and assessments, such as videos, songs, and interactive games.

She stated that, The students oftentimes do not even know they are being assessed because they are having fun while I am teaching them through a computer screen.

Mrs. Obi shared that in addition to her students completing math assessments online, they must also upload a photo of the work they completed during the test so she can look at their actual work when she is checking for understanding. Mrs. Obi also shared that she embeds a graphing calculator into each of her assessments that requires one to solve a problem and said that, by providing a graphic calculator inside of the assessments, the students usually take advantage of it because it is right in front of them and they also think it is fun to use.
Ms. Bennett shared that she uses a variety of questioning techniques when creating her math assessments, such as fill in the blank, drag and drop, and video responses. She is confident that the constant variety of questions on her assessments keep students engaged and that

*they are less likely to become disengaged because of the monotony of clicking the correct answer repeated multiple choice questions.*

**Theme Three: A variety of strategies and technology tools are incorporated into online math assessments to provide differentiated opportunities for all learners in a classroom.**

The research collected that produced this theme derived from interview question 3: *What types of technology tools do you commonly use when creating online assessments?*

Each participant in this study shared their method for differentiating assessments by using a variety of digital platforms. A common digital platform that each participant discussed using in their classroom is Nearpod. Nearpod is a digital tool that allows teachers to create interactive and engaging lessons, which are often used as a form of assessing students. Nearpod can be teacher-led, which essentially “locks” the students’ devices to a specific presentation slide, or interactive tool of the teacher’s choosing, or it can be used asynchronously.

Mrs. Paneratea shared that she creates and uses multiple Nearpod lessons a week in her class because, as she stated,
The student engagement always seems to be on a higher level when their only option is to complete the lessons and quizzes at the pace I have chosen.

As a hybrid teacher, Mrs. Carlisle shared that

Nearpod is an amazing tool that is used in my class because we can work through the lessons together, or I can allow them to work on the lessons and quizzes at their own pace, on their own time.

Mrs. Obi listed Nearpod as a tool that she had just recently learned about at a technology conference and had

incorporated a handful of lessons in her classes so far.

Nearpod was the first tool Ms. Bennett mentioned when asked what digital tools she uses in her classroom and she was excited to share that she is a Nearpod Educator, which means she has completed online professional development on her own to become a very knowledgeable user.

Mrs. Paneratea shared that it takes time to learn a new platform before integrating it into daily lessons. She shared an example of using an already created EdPuzzle activity in her classroom and did not realize that the captions were only available in Portuguese and Spanish. She shared that it is

very important to test out the digital tools through the lens of a student before assigning activities to students to ensure it is accessible and accommodates all learners that will be participating in the activity.

The majority of assignments and assessments are completed virtually in Mrs. Carlisle’s courses. She shared that her district requires all students to complete their quarterly
benchmark assessments through a specific program. She shared some disappointment in that there does not appear to be anyone working on a district-level to try out the digital platforms prior to requiring them for their students.

While Mrs. Obi did share about her willingness to learn new digital platforms to assess student learning, she also shared that does not utilize a large variety because she wants to ensure her students are proficient in the platforms she wants them to use. She also shared that,

*Desmos are a huge part of learning in our math classroom. I can craft an assignment for students and when they login they must work through the assignment and then respond so that I can grade it. This program gives me a way to incorporate the current skill being taught with an opportunity for students to use their creativity while problem solving.*

Ms. Bennett shared that she would use other programs to practice basic math facts and for daily warm ups but uses her Nearpod created lessons a majority of the time.

The participants all shared that they use the recording feature more often than any other digital component. The ways they use recordings is to submit an oral response and to narrate over something they have created. Mrs. Paneratea and Ms. Bennett both shared that the recording features help level assignment expectations for students with disabilities since they can quickly submit a recording to explain their thinking. Mrs. Carlisle shared,

*The students use technology to record their voice. They send me things back and forth which is an easier alternative to typing if they only have a smartphone with them. I really think that the recording feature has been a*
game changer for students with disabilities because they no longer have to
be proficient in writing or typing in order to submit an assignment.

Theme Four: A variety of assessment types and the use of a learning management
system (LMS) are common approaches teachers use when creating online math
assessments.

The research that produced this theme derived from interview question 4: How do
you integrate interactive components, such as interactive media, into your online math
assessments?

The participants all shared a common theme when discussing interactive
components into their online assessments which was the use of a learning management
system (LMS). All participant shared examples of the different types of questions that
are available within their LMS and also shared that they try to limit the use of multiple
choice questioning. Mrs. Paneratea shared that her LMS is the only location in which she
has personally created online assessments this year. She shared that she accesses the
premade content in every other digital platform she uses for student learning. She also
stated,

*I really appreciate the simplicity of creating assessments in Canvas. I
have taken advantage of each opportunity the district has offered teachers
for Canvas training and know that is what has encouraged my use of
Canvas.*

She went on to share that since her LMS is set up to sync grades directly to her
gradebook that it
takes the extra step out of entering grades as well as the probability of typing in a wrong grade, especially when I teach over 150 students each day.

Mrs. Carlisle also uses her LMS to administer most assessments. She shared that one of the main reasons for using the LMS is because

*it automatically rosters my new students when they begin my courses and will remove them if they transfer out of the district.*

She further discussed the constant student transfers that accompany her district’s hybrid model and the difficulty in maintaining accurate data and ensuring each student is completing the assignments and assessments as assigned. The LMS is also Mrs. Obi’s top digital platform to use, but she most often uses it for students to work their math problem of the day and to contribute to the class journal. She shared that

*it is very simple to upload an instructional video to help reteach concepts.*

*I can then have students complete an assignment or a short quiz to show what they know.*

Ms. Bennett shared that her district does not put much emphasis on teachers using an LMS, but she does use Google Classroom to upload announcements, assignments and to link a quiz. She shared,

*Since I use a Google Form as my quiz through Google Classroom, I am limited on the type of question types I can use. I do have students upload files of projects they have created, or an audio describing their thinking.*

She said she does put links to outside resources in Google Classroom for her students to access a quiz on another platform but also stated that
I wish I had a larger variety of question types to use when assigning a quiz in Google. I am constantly searching for a more creative approach to online testing.

**Theme Five: Student engagement during online math assessments can be influenced by the design features embedded in the assessment and the level of familiarity with the online tools and formats.**

Two interview questions were used for data collection for this research question:

Question 1) *How do you believe the different design features impact students’ engagement during online math assessments?* and Question 6) *Can you share any observations or student feedback regarding their engagement with the online math assessments you have created?*

The participants shared their personal observations of the engagement level for students when taking math assessments online. They all shared that the ease of use was very important for students to remain engaged as was including many different types of questions. The participants also noted that students seem to score lower on assessments when taken online when compared to taking an assessment on paper. Mrs. Paneratea shared,

*The easier an assessment is to navigate, the more engaged a student will be. If it takes 17 clicks to access specific items then they have already mentally finished before they even began.*

Mrs. Carlisle shared that if the assessment is tedious then the students lose interest almost immediately. She stated,
The assessments must have a variety of interactive pieces in order to keep the student engagement at a high level. It feels like a balancing game when creating assessments because I have to make sure that they are easy to use while also making them interactive.

Mrs. Obi shared that she frequently observes students forgetting to solve their problems on a sheet of paper before answering the question online. She stated that

*Students are less likely to pick up a pencil to do some work, things that if given an assessment on paper, they would almost always do.*

She did compliment how simple it is to embed a graphing calculator into the assessments and shared that her students typically take advantage of the calculator when it is available. Ms. Bennett shared that before every assessment, she goes over specific skills in a whole group setting to address common misconceptions and to reiterate the importance of working each problem out on paper. She also creates a file upload as the question of the test so the students can upload a photo of the work they completed during the test. Ms. Bennett said a drawback to having them take a photo of the work they completed to solve a problem is that

*they can easily share those photos with the students that will be taking the same assessment later in the day.*

She shared that she is still trying to find a fail proof system but for now has the students turn the paper with work in before leaving and does a quick check to see that they have deleted the photo that contains the math problems found on the assessment.

**Theme Six: Technical issues and limitations often interfere with student engagement when taking an online math assessment.**
Participants were asked two questions to investigate this research question:

Question 7) *Do you encounter/have you encountered obstacles when designing and administering online math assessments* and Question 8) *How do you balance the need for engagement with your district’s requirement for valid and reliable assessment measures?*

The theme that developed when asking the participants about the obstacles they face when creating online assessments highlighted the simple truth that technology is not always reliable. They shared that there have been times when they are creating an assessment and they lose internet signal, the website is down for maintenance, or they forget to save their progress and lose everything they have created. This theme also represents the reliability of the technology, including the internet, working when it is time for students to take the assessments. They all discussed that they never have to worry about these obstacles if they have students take a paper-pencil test.

Mrs. Paneratea shared that the largest obstacle she faces is

*when the internet is down or students left their Chromebooks at home so they are unable to access the online assessment.*

She discussed how it is more difficult to create online assessments in math than it is for other subjects because of the different symbols that students need to use to answer questions. She said, Obstacles other than technology being available is that online assessments are not always user friendly. Students may know how to solve the problem, but if they make a simple mistake with transferring the answer online then the entire problem will be counted incorrect, which oftentimes leads to inaccurate data.

Mrs. Carlisle shared,
Technology errors are the largest obstacles I face when administering online assessments because students often struggle with the different interactive components. When this happens, they get frustrated and then begin emailing me repeatedly. I must set a very strong process at the beginning of the school year for how to report technology errors or everyone [the students and I] will end up very overwhelmed.

Mrs. Obi said,

One major obstacle is that there’s always the fear that the Internet is going to be down. You do all this work preparing the online assessment and then when it is time to administer it to the students you realize the internet doesn’t work that day.

She went on to describe how it is even worse when most of the class is able to login and begin the test, but there may be one or two students that cannot access it, which leads to a lot of frustration. She said,

The students should not have to worry about an assessment not being available for them, but, instead, they should be focused on the assessment they are going to take.

Ms. Bennett shared that it is common for the students to lose connectivity because of her location in the school building. She is very cautious when planning out assessments and has learned that she must always have a backup plan as she used to become very overwhelmed and anxious when an assessment did not work for students. She shared that

As much as I love administering assessments online, there has to be a way to ensure the technology is more reliable than it is.
She also stated that students will often become disappointed upon learning that their math assessment will be online instead of on paper. She said,

*I think the students are just as anxious when it is time to take an assessment online because they fear that something will stop working and they will lose the problems they have already worked so hard to solve.*

She also said that is one main reason for telling them to solve each problem on a sheet of paper before entering the answer online so that it will save time if they must start the test over due to technical errors.

**Summary**

Chapter IV contained then data gathered from the interviews. This data was presented in the form of narratives of the participants’ responses. This chapter presented findings from surveys and interviews of the four participants that completed the entirety of their interview. The responses addressed the perception they had on the different aspects of online math assessments and the effect they have on student engagement. The analysis conducted by the researcher revealed that these teachers found value in using technology in their classrooms, including during assessments, which is discussed thoroughly in Chapter V. The lack of trust teachers have with technology working was also evident during each of the interviews. In the next chapter, the researcher will discuss the findings and future research that should be explored further, in addition to implications found in this study.
CHAPTER V

CONCLUSION

The research problem that this dissertation explored was how teachers conceptualize and create online math assessments to actively engage middle school students, including the benefits and challenges associated with online assessments and the impact online assessments have on student engagement. This chapter discusses the study’s findings and implications as well as provides recommendations for future research. The chapter is organized into four parts: (a) summary of the research; (b) discussion of the findings; (c) implications from the research; and (d) recommendations for future research.

Summary of Research

The study focused on the effect that teacher-created online math assessments have on student engagement. Four participants that currently teach middle school math in Oklahoma were interviewed for this study. The four participants were a public-school teacher in a suburban district in Central Oklahoma, a private school teacher in northeastern Oklahoma, a teacher from a hybrid charter school in Oklahoma, and a public-school teacher from a rural district in southeast Oklahoma. The participants were interviewed online using Google Meet and shared personal perspectives from the creation and use of online assessments in their math classrooms. The eight open-ended, semi-structured interview questions were constructed using Flanagan’s (1954) Critical
Incident Technique, which examines an individual’s actions and assesses how a particular behavior influences the attainment of educational objectives (see Appendix D for interview questions). The interview questions were designed to gain an understanding of the following: the process used by teachers when creating online math assessments, the benefits and challenges associated with online assessments in mathematics, and the effect online math assessments have on student engagement.

The interviews were automatically transcribed while the Google Meet was being recorded and were uploaded to the researcher’s Google Drive. The researcher used Braun and Clarke’s (2006) six-phase thematic analysis to develop themes for each research question. Upon completion of the six-phase thematic analysis, five themes were derived by the researcher:

(1) teachers must consider the diverse needs of students when creating online assessments for math;
(2) technology is integrated for reinforcing strategies across a variety of available platforms;
(3) a variety of strategies and technology tools are incorporated into online math assessments to provide differentiated opportunities for all learners in a classroom;
(4) a variety of assessment types and using a learning management system (LMS) are common approaches teachers use to create online math assessments;
(5) student engagement during online math assessments can be influenced by the design features embedded in the assessment and the level of familiarity with the online tools and formats;
(6) technical issues and limitations often interfere with student engagement when taking an online math assessment.

Discussion of Findings

This section outlines the study’s findings. The guiding research questions for this study were developed from the researcher’s previous observations as a former middle school math teacher, the review of literature regarding student engagement when taking math assessments online, and feedback from the dissertation committee. Data was collected during online interviews in which all participants were asked the same set of questions. Due to the nature of the semi-structured interview questioning and the responses collected, research questions one and two each yielded two themes, while research questions three and four each yielded one.

This section is organized by research question and the themes found for each one. It is important to note that only one theme was found to answer research question three and research question four. A primary goal of this dissertation was to discover the design process teachers use when creating online math assessments.

**RQ1: What factors do mathematics teachers prioritize when conceptualizing the design process to create engaging online assessments?**

The purpose of this research question was to determine if teachers followed district expectations and provided platforms when creating assessments. The analysis method in Chapter III was used to analyze the participant interview responses, resulting in the discovery of two themes, which are discussed in detail below.

This study first explored if teachers followed district expectations or created their own system when creating online assessments to answer research question one. The first
theme revealed that the teachers interviewed in this study must consider the diverse needs of students when creating online assessment for math. Mrs. Carlisle provided a strong statement to attest to the learning needs among her students which was cited in the Interview section of Chapter IV. The diverse needs of students can include a wide variety of learners; however, the characteristics described by the participants in this study were academic ability, physical ability and language. The survey results aligned to the interview data when all 46 respondents agreed that technology can be an effective learning tool for students. One strategy to assist the learner diversity in a classroom is by incorporating the Universal Design for Learning (UDL).

The 2024 National Educational Technology Plan included the three main principles of UDL in their suggestions for implementing technology in the classroom to account for students with diverse learning needs. Multiple Means of Representation is one of the three main principles of UDL, which allows educators to present information in multiple ways by using digital tools. Teachers can record lessons for students to play back at a later time, change the font sizes, and enable text-to-speech for students with learning disabilities. One participant shared that the first few weeks of school are spent working through online assignments and assessments together as a whole group so the students do not face unfamiliar barriers when tasked to complete online assignments and assessments on their own throughout the school year.

The second theme presented in the survey and interviews was the use of technology to reinforce strategies by using a variety of available online platforms. The participants shared that their students struggle to transfer math problems from a computer screen to a sheet of paper and then back to a computer screen. A specific scenario given
in an interview is that students must learn to rewrite a math problem onto a sheet of paper so they can work through the steps of solving the problem. Once they have solved the problem, they are then required to enter the answer back onto the computer using a keyboard. The participants shared that students have a difficult time transferring the information back and forth and that key details are often left out which causes students to get the problem incorrect when submitting their answers online. To attempt to combat this grievance, the participants shared they consistently model how to transfer math problems to paper to their students. One participant found that students began to score higher on assessments when she allowed the use of an online calculator, while another participant stated multiple questioning techniques are used throughout assessments, including the ability to work their problems on a blank page of their computer using their touchscreens to write. It is important for teachers to recognize the learner diversity in their classroom and use accessibility functionality, such as UDL, to ensure the online math assessment is effective for accommodating diverse learning needs.

RQ2: How do mathematics teachers incorporate technology and interactive components into their online math assessments?

The second research question aimed to learn the different approaches teachers use when creating online math assessments. The first theme that emerged when analyzing data for this research question was that a variety of strategies and technology tools are incorporated into online math assessments to provide differentiated opportunities for all learners in a classroom. According to the participants in this study, the platform Nearpod is widely used in their classrooms, and schools, to guide students through their learning objectives. Nearpod has the capability of being teacher-led, which locks students into
specific learning slides and activities, or it can be completed asynchronously by students. The participants each shared how Nearpod has a resource library that has pre-made lessons that are vetted by classroom teachers and teachers contracted through Nearpod to ensure accurate information is being created and shared. The ease of use of this platform was a common talking point among participants. This aligns with Klinger’s (2010) study that found a deficit in pre-service teacher programs regarding the creation of content and how teachers heavily depend on pre-made content from other sources. While Nearpod provides lessons for teachers as well as the ability for teachers to create their own lessons, it is imperative that they are creating lessons that have rich tasks embedded into them and that allow students to take ownership of their learning. Suurtaam et al. (2018) found that assessments should include “rich tasks that provide opportunities for students to engage with problems of interest to them” which could include tasks such as the Three-Act Mathematics Tasks that were introduced in Chapter II.

The participants also shared how there are a plethora of online learning platforms and that it often becomes overwhelming to keep up with and learn how to use these new resources. One participant shared that it is important for the teacher to test the digital tools available on the different platforms before assigning to students to ensure it is accessible and accommodating to all learners in the classroom. There is a caveat to teachers trying new technology tools as the survey indicated that 47% of respondents become anxious to try new technologies because they do not know how to troubleshoot when issues arise. Each interview participant shared that they use the recording features on different online programs more often than any other digital tool available. The recording tool is used by both the teacher to model the lesson and expectations as well as
for students to record themselves thinking through the math problems. The recording tool is categorized in the multiple means of representation principle of the UDL framework.

The second theme derived from the researcher for research question two was that the variety of assessment types and the use of a learning management system (LMS) are common approaches teachers use when creating online math assessments. Each of the participants use an LMS in their classrooms for daily learning tasks. One of the top reasons the participants shared their consistent use of an LMS is that students are automatically added and dropped when enrolled at their school or when they move away. One participant shared that she has a very large student count in her classes and that it is very time consuming when she must add and remove students from different platforms, but the use of an LMS ‘takes the burden off of the teacher.’ The digital tools available in an LMS that commonly came up in the interviews were the variety of different types of questions for quizzes and assessments and the ability for students to upload photos of the work they complete on paper when solving the math problems. The participants shared that having the students upload photos of their work encourages accountability for students completing the work and deters many students from cheating on assignments and assessments. It is important for students to understand ‘the why’ of taking the assessments and to also understand why it is important for them to show their thinking. Teachers must remember the four conditions that must be satisfied for students to work productively (Stiggins & DuFour, 2009) even when shifting assignments and assessments online. It is important for the teachers to continue setting clear learning targets, commit
to standards-based instruction, provide high-quality assessments, and communicate effectively (Stiggins & DuFour, 2009).

Math teachers use a variety of strategies and technology tools to create engaging online math assessments that cater to the diverse needs of learners. The integration of an LMS allows teachers to implement a variety of question types for assessments and promote student accountability, which align directly with Stiggins and DuFour’s (2009) four conditions and were referenced in Chapter II.

**RQ3: What are mathematics teachers’ perceptions regarding the influence of these elements on student engagement and learning outcomes?**

The purpose of this research question was to confirm or disprove that the interactive components affect learner engagement when taking online math assessments. For research question three, the one theme found was that student engagement during online math assessments can be influenced by the design features embedded in the assessment and level of familiarity with the online tools and formats. The latter part of the theme aligns directly with the first theme found for research question one. The level of familiarity with the online tools and formats of the assignments and assessments is vital when requiring students to undergo assessments that are online. A study conducted by Backes & Cowan (2018) found that there is no explanation for students scoring lower on computer-based assessments but there was strong evidence of the modality of the test influencing student outcomes, although Aspiranti et al. (2020) found no correlation between the modality of the test and the student test scores. It is crucial for teachers to eliminate the barriers associated with online assessments, such as familiarity with the platform, before using the assessment to guide instructional decisions.
The participants each perceived the design features embedded into online math assessments as having an effect on student engagement while taking the assessment. The survey aligned with the participant statements because 70% of survey respondents believe students are engaged with taking assessments online and 84% of respondents indicated their students get excited when they use technology in their learning process. While ensuring teachers are assessing students over conceptual understanding, reasoning, and procedural fluency (Van den Heuvel-Panhuizen & Becker, 2003), they must do this in an engaging way in order to gain a true understanding of the students’ abilities. One participant shared that, “the easier an assessment is to navigate, the more engaged a student will be,” while another participant shared that students lose interest almost immediately when an assessment with tedious tasks is given. Teachers must continue to use creative techniques when creating math assessments to “enhance their sense of enjoyment” (Al-Bogami & Elvas, 2020, p.11). One participant shared that she goes over specific skills in a whole group setting and discusses the different questioning techniques that will be used to assess the students. In doing so, she is promoting active engagement before the students even begin the assessment and limiting questions that could cause distractions since a study by Aagaard (2015) found students frequently encounter habitual distractions while using technology devices in classrooms. The participants believe it is crucial for students to be engaged while taking their math assessment and not just merely rapidly guessing, as described by Kuhfeld and Soland (2020).

In summary, the math teachers interviewed for this study perceive the design features embedded in an online math assessment to significantly influence student engagement and emphasize the importance of familiarity with online tools and platforms.
It is crucial for teachers to address barriers associated with online assessments to ensure an accurate assessment of the students’ abilities which guide instructional decisions and ultimately enhance learning outcomes.

**RQ4: What challenges do mathematics teachers face when creating online math assessments, and how do they adjust their approaches to overcome these challenges to ensure the assessments are both effective and engaging for students?**

The purpose of this research question was to understand common challenges teachers face when creating online math assessments and the ability, or lack of, to improve the tool. The following theme emerged when analyzing the data using the analysis method discussed in Chapter III: Technical issues and limitations often interfere with student engagement when taking an online math assessment. The largest challenge shared by the interview participants when creating online math assessments is the unreliability of technology. Each of the participants shared that is the primary reason why it is complicated for them to create a math assessment online instead of handing out a paper and pencil copy of the assessment.

The US Department of Education (2024) wrote that “many communities still lack access to reliable, high-speed broadband and technology tools,” which is a crucial element if teachers and students are making the shift to online assessments. Abduh’s 2020 study found that “the majority [of teachers] encountered serious challenges in online assessments” (p.16). While there may not ever be a guarantee that technology, including the internet, will work 100% of the time, it is important for teachers to have the basic knowledge on how to navigate the situation when it arises.
One participant shared that it is more difficult to create a math assessment online than any other subject because of the different symbols students need to use when answering. Again, DeLuca and Klinger (2020) shared there is a lack of training for pre-service teachers and how to create assessments, especially online. The survey aligned with these participant comments because the data showed that 29% of respondents do not have curriculum support in their building to help with technology integration into their lessons. With proper training and experiences, teachers could find alternative ways for students to enter their answers or provide a handout on how to key in the symbols needed for specific assessments. One participant shared how technology errors are the largest obstacle she faces when administering assessments online, which was cited in the Phase Two: Interview section of Chapter IV.

Technical issues present a significant challenge to the effectiveness and engagement of online math assessments, as highlighted by the findings of this study. While the unreliability of technology remains a primary obstacle for teachers, addressing this challenge through proper training and establishing robust processes for managing technology errors can help teachers handle disruptions to improve the overall math assessment experience for students.

**Implications**

The findings of this study shed light on the different aspects of online math assessment creation and implementation. The teachers in this study prioritize the diverse needs of their students when creating online assessments and integrating technology to reinforce mathematical strategies. Incorporating interactive components and using learning management systems (LMS) are
common strategies used by these teachers to provide differentiated opportunities for learners and to enhance student outcomes.

These teachers also perceived the design features embedded in online math assessments to significantly influence student engagement. Familiarity with online tools and platforms continued to emerge as a crucial factor to ensure effective student engagement during online math assessments. Addressing these factors is essential for accurately assessing the abilities of students and guiding instructional decisions to enhance learning outcomes.

Technical issues and limitations pose significant challenges to the effectiveness and engagement of online math assessments in the classroom for the teachers studied. The lack of reliability with technology remains a primary obstacle for these teachers, which impacts the creation and administering of online math assessments. Addressing these challenges through proper training and establishing robust processes for managing technology issues is crucial to improving the overall online math assessment experience for both teachers and students.

**Recommendations for Future Research**

Drawing from both the data gathered and the literature review, numerous recommendations can be made for future research. First, more research should be conducted on pre-service teacher courses required and available professional developments that center on the design of assessment. Teachers are required to assess students to collect data on their abilities, but many have never received training on how to create assessments that target the specific needs in their
classroom. Second, future research could be conducted to examine how the use of AI can alter the process teachers undergo when creating online assessments. Another future study could research how the ability to design assessments is influenced by the different pathways taken to become a teacher. And finally, a future research study could use the method and framework provided in this study to observe the effect that online assessments have on student engagement across all subject areas.

**Limitations**

Due to inherent constraints, a dissertation is limited and unable to cover all aspects of a topic. Therefore, the researcher anticipates and acknowledges potential limitations in the scope of the study. This included a low survey response rate, participants not accepting the invitation for an interview, and the limited diversity of background of the four individuals interviewed.

**Summary**

The themes identified for each of the research questions were analyzed, peer reviewed, and were substantiated by evidence found in the data. The thematic analysis provided insights into the design process for teacher-created online math assessments, the influences of student engagement, and barriers associated with online assessments in a math classroom. Work still needs to be done to provide consistency with online platforms used for assessments and reliable technology access to all school districts in the state of Oklahoma. This research added to the qualitative literature on future research in online math assessments for middle school learners.
REFERENCES


Books on Demand.


APPENDICES

APPENDIX A

Oklahoma State University Institutional Review Board

Date: 02/08/2024
Application Number: IRB-24-52
Proposal Title: Exploring the Impact of Teacher-Created Online Assessments on Learner Engagement in Middle School Math

Principal Investigator: Jenny Chartney
Co-Investigator(s): Tutilemi I. Asino
Faculty Adviser: Tutilemi I. Asino
Project Coordinator: Tutilemi I. Asino
Research Assistant(s): Tutilemi I. Asino

Processed as: Exempt
Exempt Category:

Status Recommended by Reviewer(s): Approved

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in 45CFR46.

This study meets criteria in the Revised Common Rule, as well as, one or more of the circumstances for which continuing review is not required. As Principal Investigator of this research, you will be required to submit a status report to the IRB triennially.

The final versions of any recruitment, consent and assent documents bearing the IRB approval stamp are available for download from IRBManager. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:
1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be approved by the IRB. Protocol modifications requiring approval may include changes to the title, PI, adviser, other research personnel, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3. Report any unanticipated and/or adverse events to the IRB Office promptly.
4. Notify the IRB office when your research project is complete or when you are no longer affiliated with Oklahoma State University.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact the IRB Office at 405-744-3377 or irb@okstate.edu.

Sincerely,
Oklahoma State University IRB
APPENDIX B

Informed Consent Form

College of Education & Human Sciences

PARTICIPANT INFORMATION FORM
Exploring the Impact of Teacher-Created Online Assessments on Learner Engagement in Middle School Math

Background Information
You are invited to be in a research study that investigates the use of online assessments and the effect they have on engagement in a middle school math classroom. We ask that you read this form and ask any questions you may have before agreeing to be in the study. Your participation in this research is voluntary. There is no penalty for refusal to participate, and you are free to withdraw your consent and participation in this project at any time. You can skip any questions that make you uncomfortable and can stop the interview/survey at any time. There is no penalty for refusal to participate.

This study is being conducted by: Jenny Chartney, Ph.D. Candidate, Learning Design, and Technology at Oklahoma State University, under the direction of Dr. Tautalme Asino, associate professor, College of Educational Foundations, Leadership & Aviation at Oklahoma State University.

Procedures
If you agree to be in this study, we would ask you to do the following things: You will be asked to complete an online survey. The survey will include questions related to your experiences with online assessments in the classroom and will take approximately 16 minutes to complete. Your responses will be kept confidential, and no personally identifiable information will be disclosed. Those participants who complete the survey will also be asked if they are interested in participating in a one-hour follow-up interview. Participants interested in participating in the interview will be asked to submit their name and email address for further communication.

Participation in the study involves the following time commitment: 5-10 minutes to complete the online survey in its entirety. One additional hour if selected to participate in an online interview.

Risks and Benefits of being in the Study
The study involves the following foreseeable risks: There are no known risks associated with this project, which are greater than those ordinarily encountered in daily life. Survey responses are anonymous. Those who wish to participate in a follow-up interview will provide contact information for the researcher. Follow-up interviews will occur online, and all identifiable information will be removed from the video recording and transcripts of the interview. In order to assist with the offset of these risks, participant names and other identifiable information will be coded to provide anonymity of participants. There is a potential risk of breach of confidentiality which is minimized by using pseudonyms and storing information on a password-protected flash drive.

The benefits to participation are:
There are no direct benefits for participating in the survey. This study aims to benefit mathematics teachers in designing assessments by identifying the advantages and obstacles related to the integration of online assessment methods.

Compensation
If chosen to participate in an online interview, you will receive one $25 Amazon gift card as compensation for your participation. You will receive payment immediately upon the conclusion of the interview. To be eligible to receive the compensation, you need to complete the online interview in its entirety.

Confidentiality

Online Survey

Approved: 02/08/2024
Protocol #: 183-24-22

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The information you give in the study will be stored anonymously. This means that your name will not be collected or linked to the data in any way. Only the researchers will know that you have participated in the study, if you choose to provide your name. The researcher will not be able to remove your data from the dataset once your participation is complete.

**Online Interview**
The information that you give in the study will be handled confidentially. Your information will be assigned a code number/pseudonym. The list connecting your name to this code will be kept in a locked file. When the study is completed and the data have been analyzed, this list will be destroyed. Your name will not be used in any report.

Because of the nature of the data, I cannot guarantee your data will be confidential and it may be possible that others will know what you have reported. The researchers will make every effort to ensure that information about you remains confidential, but cannot guarantee total confidentiality. Your identity will not be revealed in any publications, presentations, or reports resulting from this research study.

We will collect your information through an online survey and interview. This information will be stored on a password-protected flash drive in a locked filing cabinet, only accessible by researcher. When the study is completed and the data have been analyzed, the code list linking names to study numbers will be destroyed. This is expected to occur no later than August, 2024. The audio/video recording will be transcribed. The recording will be deleted after the transcription is complete and verified. This process should take approximately 2 weeks.

The research team works to ensure confidentiality to the degree permitted by technology. It is possible, although unlikely, that unauthorized individuals could gain access to your responses because you are responding online. However, your participation in this online survey involves risks similar to a person’s everyday use of the Internet. If you have concerns, you should consult the survey provider privacy policy at https://www.qualtrics.com/privacy-statement.

**Contacts and Questions**
The Institutional Review Board (IRB) for the protection of human research participants at Oklahoma State University has reviewed and approved this study. If you have questions about the research study itself, please contact the Principal Investigator at (580) 955-4299, jcharin@okstate.edu. If you have questions about your rights as a research volunteer or would simply like to speak with someone other than the research team about concerns regarding this study, please contact the IRB at (405) 744-3377 or irb@okstate.edu. All reports or correspondence will be kept confidential.

**Statement of Consent**
I have read the above information. I have had the opportunity to ask questions and have my questions answered. I consent to participate in the study.

Indicate Yes or No:
I give consent to be audiotaped during this study.
___ Yes  ___ No

I give consent to be videotaped during this study:
___ Yes  ___ No

I give consent to be contacted for follow-up in this study or future similar studies:
___ Yes  ___ No

Signature:_________________________________________ Date:__________

Signature of Investigator:____________________________ Date:__________

Approved: 02/08/2024
Protocol #: IRB-24-52
APPENDIX C

Survey

Do you currently teach at least 1 section of mathematics in a middle school setting?

- Yes
- No

Skip To: End of Survey If Do you currently teach at least 1 section of mathematics in a middle school setting? = No

For your mathematics class(es): In the last 5 class days, on how many days did you use a Computer-Based Assessment?

- 0
- 1
- 2
- 3
- 4
- 5
- NA
How many years of teaching experience do you have including this year?

- 1-5 years
- 6-10 years
- >11 years

What is the grade level you primarily teach?

- 5th Grade
- 6th Grade
- 7th Grade
- 8th grade

Have you been provided any training or professional development on the use of assessments in the last 12 months?

- Yes
- No

Have you been provided any training or professional development in the use of instructional technology in the last 12 months?

- Yes
- No

In the last 30 days, have you discussed with other teachers, any methods that one could use to assess student learning?

- Yes
- No
During the last 30 days, have you discussed with other teachers how to use instructional technology in the classroom?

○ Yes

○ No

Do you currently teach at least two classes that have a state-mandated standardized test at the end of the course?

○ Yes

○ No

**Directions:**
For the next set of questions, select the response that best fits your level of agreement to the given statement.

**Strongly Agree = 4, Agree= 3, Disagree= 2, Strongly Disagree= 1**
<table>
<thead>
<tr>
<th>Statement</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
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<tbody>
<tr>
<td>I feel comfortable about my ability to work with instructional technologies.</td>
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<tr>
<td>Learning new technologies is confusing for me.</td>
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<td>I get excited when I am able to show my students a new technology or tool.</td>
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<tr>
<td>I enjoy finding new ways that my students and I can use technology in the classroom.</td>
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<tr>
<td>I get anxious when using new technologies because I may not know what to do if something goes wrong.</td>
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<tr>
<td>I am confident in my ability to troubleshoot when problems arise while using technology.</td>
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<td>Learning new technologies that I can use in the classroom is important to me.</td>
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<tr>
<td>I am confident in trying to learn new technologies on my own.</td>
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</table>

**Directions:**
For the next set of questions, select the response that best fits your level of agreement to the given statement.

**Strongly Agree = 4, Agree= 3, Disagree= 2, Strongly Disagree= 1**
### Teacher Autonomy

<table>
<thead>
<tr>
<th>Statement</th>
<th>4 Strongly Agree</th>
<th>3 Agree</th>
<th>2 Disagree</th>
<th>1 Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am able to select assessments for my students on my own.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have the freedom to design and prepare assessments in my own way.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am allowed to assess students in the manner that I want. (ex. paper and pencil or online)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have the freedom to use mobile devices and other technology in a flexible way in my lessons.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Directions:**
For the next set of questions, select the response that best fits your level of agreement to the given statement.

**Strongly Agree = 4, Agree= 3, Disagree= 2, Strongly Disagree= 1**

### Perceived Benefit in Using Technology in the Classroom

<table>
<thead>
<tr>
<th>Statement</th>
<th>4 Strongly Agree</th>
<th>3 Agree</th>
<th>2 Disagree</th>
<th>1 Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer technology allows me to create assessments that enhance the learning experience.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer technologies help me be better organized in my classroom.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My students get excited when they use technology in the learning process.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My students are engaged with taking assessments online.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology can be an effective learning tool for students.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Directions:**
For the next set of questions, select the response that best fits your level of agreement to the given statement.

*Strongly Agree = 4, Agree= 3, Disagree= 2, Strongly Disagree= 1*

**Technology Vision and Support**

<table>
<thead>
<tr>
<th>Statement</th>
<th>4 Strongly Agree</th>
<th>3 Agree</th>
<th>2 Disagree</th>
<th>1 Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A vision for technology use in our school is clearly communicated with faculty.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curriculum support is available in my building to assist with technology integration ideas.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My building principal encourages faculty to integrate technology in the classroom.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology support is available in my building to assist with troubleshooting.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My colleagues are committed to integrating technology in the classroom.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Select all of the Computer-Based Assessment applications that you have used with your students during class in the last 30 days. Select all that apply from this list.

☐ GoFormative
☐ Google Forms Quiz
☐ IXL
☐ Kahoot
☐ Quizlet Live
☐ Quizizz
☐ Nearpod
☐ Plickers
☐ Poll Everywhere
☐ Prodigy
☐ Quiz features embedded into a Learning Management System (Schoology, Canvas, Google Classroom, etc.)

☐ None used in the last 30 days.

List all other Computer-Based Assessments not listed in the previous question that you have used with your students in class in the last 30 days. Please separate each entry with a comma. Please use N/A if not applicable.

________________________________________________________________

Are you interested in participating in an online follow-up interview to discuss the use of assessments and online learning in your math classroom?
If you select yes, you will be asked to provide your name and email address on the next page.
If you select no, you will be prompted to submit this survey and will remain anonymous.
*If you are selected to participate in a follow-up interview, you will receive a $25 Amazon gift card upon the completion of the interview.

○ Yes

○ No

Skip To: End of Survey If Are you interested in participating in an online follow-up interview to discuss the use of assess... = No

Name Please provide your name.

________________________________________________________________

Email Please provide your email for further communication regarding this study.

________________________________________________________________
APPENDIX D

Interview Questions

1. How do you believe the different design features impact students’ engagement during online math assessments? (RQ 3)

2. Can you describe the key considerations, including the level of question difficulty, when designing online math assessments for engagement? (RQ 1)

3. What types of technology tools do you commonly use when creating online math assessments? (RQ 2)

4. How do you integrate interactive components, such as interactive media, into your online math assessments? (RQ 2)

5. Can you provide examples of specific strategies or features that you include to make online math assessments more engaging for students? (RQ 1)

6. Can you share any observations or student feedback regarding their engagement with the online math assessments you have created? (RQ 3)

7. What obstacles do you/have you encounter/ed when designing and administering online math assessments? (RQ 4)
   
   Follow Up: Can you share an example of a challenge you faced while creating online math assessments and what adjustments you made to overcome it?

8. How do you balance the need for engagement with your district’s requirement for valid and reliable assessment measures? (RQ 4)
APPENDIX E

Interview Questioning Data Matrix

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Interview Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>What factors do mathematics teachers prioritize when conceptualizing the design</td>
<td>• Can you describe the key considerations, including the level of question difficulty, when designing online math assessments for engagement?</td>
</tr>
<tr>
<td>process to create engaging online assessments?</td>
<td>• Can you provide examples of specific strategies or features that you include to make online math assessments more engaging for students?</td>
</tr>
<tr>
<td></td>
<td>• What types of technology tools do you commonly use when creating online math assessments?</td>
</tr>
<tr>
<td></td>
<td>• How do you integrate interactive components, such as interactive media, into your online math assessments?</td>
</tr>
<tr>
<td>How do mathematics teachers incorporate technology and interactive components into</td>
<td></td>
</tr>
<tr>
<td>their online math assessments?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• How do you believe the different design features impact students’ engagement during online math assessments?</td>
</tr>
<tr>
<td></td>
<td>• Can you share any observations or student feedback regarding their engagement with the online math assessments you have created?</td>
</tr>
<tr>
<td>What are mathematics teachers’ perceptions regarding the influence of these elements</td>
<td></td>
</tr>
<tr>
<td>on student engagement and learning outcomes?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Do you encounter/have you encountered obstacles when designing and administering online math assessments?</td>
</tr>
<tr>
<td></td>
<td>• How do you balance the need for engagement with your district’s requirement for valid and reliable assessment measures?</td>
</tr>
<tr>
<td>What challenges do mathematics teachers face when creating online math assessments,</td>
<td></td>
</tr>
<tr>
<td>and how do they adjust their approaches to overcome these challenges to ensure the</td>
<td></td>
</tr>
<tr>
<td>assessments are both effective and engaging for students?</td>
<td></td>
</tr>
</tbody>
</table>

Note. Interview data matrix in Table 2 provides an understanding of how the data from the interview questions answered each research question.
Hello Middle School Math Teacher!

My name is Jenny Charruey and I am a doctoral candidate at Oklahoma State University. I am interested in understanding more about the assessments you use to evaluate student learning, along with the testing methods implemented in your classroom. The questions in the survey (linked below) are designed to give a sense of the assessments/practices in your classroom. Upon completion, you will have the option to provide your name and email to be entered into a follow-up virtual interview. If chosen, you will receive a $25 Amazon Gift Card as the completion of the online interview.

**Survey Link**

Research Title:

Exploring the Impact of Teacher-Created Online Assessments on Student Engagement in Middle School Math

**Purpose of the Study:**

The purpose of this study is to explore how teachers conceptualize and utilize online math assessments that actively engage middle school students. By identifying the strategies used by educators in creating these assessments, the study aims to uncover the benefits and challenges associated with the implementation of online assessments. Additionally, the research will explore the advantages and disadvantages online assessments have on student engagement in the context of middle school mathematics education.

**Survey Deadline:**

The survey will be open until February 28, 2023. Kindly request that you complete it at your earliest convenience.

If you have any questions or concerns about the survey or the research, please do not hesitate to reach out to me at Jenny.Charruey@okstate.edu. If you have questions about your rights as a research participant, you may contact the Institutional Review Board (IRB) at 405-744-3177 or oirb@okstate.edu.

Thank you for considering this request and I look forward to receiving your valuable input.

Sincerely,

Jenny Charruey
Oklahoma State University
Jenny.Charruey@okstate.edu
(515)775-424
Calling ALL
MIDDLE SCHOOL MATH TEACHERS!

I need YOU to participate in a 5 minute doctoral research survey about the types of assessments used in your classroom!

At the completion of the survey, provide your name and email for a chance to receive a $25 Amazon Gift Card*.

*if selected for a follow-up interview

For more information email
Jenny.Chartney@okstate.edu
VITA

Jennifer Nicole Chartney

Candidate for the Degree of

Doctor of Philosophy

Thesis: EXPLORING THE IMPACT OF TEACHER-CREATED ONLINE ASSESSMENTS ON LEARNER ENGAGEMENT IN MIDDLE SCHOOL MATH

Major Field: Learning, Design, and Technology

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in Learning, Design, and Technology at Oklahoma State University, Stillwater, Oklahoma in May 2024.

Completed the requirements for the Master of Education in Educational Leadership at University of Central Oklahoma, Edmond, Oklahoma in 2017.

Completed the requirements for the Bachelor of Science in Elementary Education at University of Central Oklahoma, Edmond, Oklahoma in 2012.

Experience:

Oklahoma City Public Schools, Innovative Learning Specialist, 2023-2024
Central Middle School, Edmond Public Schools, Middle School Math Teacher, 2021-2023
Edmond Public Schools, Instructional Technology Consultant, 2018-2021
Ida Freeman Elementary, Edmond Public Schools, 4th Grade Math Teacher, 2012-2018

Professional Memberships:

International Society for Technology in Education
Oklahoma Society for Technology in Education