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An Analysis of Experiential Learning as a Means of Student and Teacher Engagement in Middle School Math Classrooms

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Abstract

This study investigates experiential learning in middle school math classrooms as a contributing factor to student and teacher engagement. Experiential learning is conceptualized as the use of student-directed learning, tactile manipulation, artistic projects, and movement-based activities to enhance understanding of a concept. Research was conducted through qualitative interviews with ten middle school math teachers at public, public charter, and private middle schools in Buncombe County, North Carolina. Participants were selected using a quota sampling strategy to ensure variation in schools. The analysis of the interviews examines varying definitions of experiential learning, advantages and disadvantages with the mode and student engagement factors including enjoyment, comprehension, and confidence. It also addresses teacher engagement factors including morale and student relationships. The objective of this research is to explore experiential learning as an effective educational tool in math classrooms through teachers' observations and first hand use of the technique. Findings of the study show that student and teacher participants of experiential learning benefit from the model. Students exhibit increased engagement through enjoyment, comprehension, and confidence and teachers engage through creative lesson planning and building the necessary relationships with students to create a safe and healthy classroom experience.

1. Introduction

Experiential learning is a teaching technique that allows students to interact with the course material through projects, discussion, and movement.[22] It is used in many classrooms to supplement or entirely replace traditional lecture-style teaching. The following research will examine the advantages and disadvantages of experiential learning in this setting, focusing on student and teacher engagement in the classroom with this model. The study will consider broad comparisons of the model by current teachers as well as specific investigations of experiential learning on the basis of age, gender, race, socioeconomic status, and academic achievement.

2. Literature Review

Extensive research has been conducted in the fields of experiential learning, mathematics education, teacher attitudes, and student morale in the classroom. Understanding the role these concepts play together is crucially important in evaluating and understanding current educational procedures.

2.1 Experiential Learning

A large portion of the classroom experience for youth is a sedentary, lecture style environment. A traditional class period includes either a lecture or a combination of a lecture and a short project or discussion based activity. This model of teaching, referred to by Lawrence O. Hamer as "passive learning," is an environment in which "students take notes without actively being engaged in the lecture material."[8] On one hand, this classroom environment is effective in sharing a large amount of information in a limited amount of time, to a large volume of students. Given this practice, it seems fitting for a classroom in a large college setting. However, in all other settings, such teaching practices do not facilitate student learning because "they do not encourage students to process information actively."[8] Additionally, Hamer notes students do not stay "sharply and continuously" engaged in a lecture past the initial fifteen minutes.[8] In opposition to passive learning, Hamer presents multiple "active learning" techniques that encourage student participation in the classroom through "nonexperiental," "semistructured experiential," and "loosely structured experiential" engagement.[8]

In an experiment of teaching styles in a college marketing classroom, Hamer found that students who attended classes that used semistructured experiential and loosely structured experiential learning activities "performed better on multiple choice final exams than students taught using lectures," suggesting at least a correlation between teaching style and learning outcomes.[8] The experiment investigated these teaching techniques both in courses with a large amount of fact and theory based learning, as well as courses that were devoted to applying concepts to particular situations.[8] This suggests experiential learning can be advantageous in a variety of classes producing more favorable outcomes on exams and overall student performance and engagement.

All forms of experiential learning are divided into two categories: daily life experiences and events that facilitate growth and programs designed to create such growth outside of the authentic context. Davidovitch describes the process of learning as a cyclical process of five stages: occurrence, sharing, processing, generalization, and application.[5] In classroom experiential learning, teachers facilitate this cyclical process rather than leading it.[24] Patterson describes these stages similarly. In traditional experiential learning programs, activities take the form of an overview of concepts with a concrete experience, reflection and observation about the experience, "abstract conceptualization" involving an adjustment of process based on initial results, and then an additional experimentation given the adjustments.[24] This process is cyclical and continues until the student has gained substantial mastery of the topic. The processes that Davidovitch and Patterson explain are the product of D.A. Klob's research that led to his 1984 work, *Experiential Learning: Experience as the Source of Learning and Development*. This book synthesized the work of many educational and developmental psychologists and introduced Klob's experiential learning theory, which is now cited in many experiential learning texts.[4]

The general theme in all active learning models is a technique that gives students real world and tangible applicable experiences for the course content. It requires deep processing and critical thinking and leads to "increased instructor and student enthusiasm, increased student performance on graded assignments, self-reported student enjoyment of the techniques and enhancement of learning, and self-reported student increases in the perceived value of the learning experience."[8]

2.2 Teacher Morale

An instructor's enthusiasm is a key component in gaining and maintaining student engagement in the classroom. In a study on teachers' attitudes regarding a shift in the Core Math Curriculum, Carol Marion notes, "Teachers' deep-rooted beliefs serve as a filter through which they view the world and interpret information. All teachers possess beliefs about their students, the curriculum, and the subject they teach."[20] In a qualitative study of college students' memories of their K-12 mathematics education, many students reported their feelings toward math being reflective of their teachers' attitudes toward the subject. Domino notes the mathematics teachers who showed passion for math and for teaching "had interesting lessons" and "went out of their way to make sure that their students were learning mathematics."[7] Domino also found a correlation between mathematical achievement and positive attitudes toward mathematics. Both the students' achievement and attitudes toward mathematics were related to the attitudes presented by the teacher. As Hamer notes, experiential learning is found to increase teacher enthusiasm in the classroom. Hamer's, Marion's, and Domino's claims suggest that a teacher who is actively engaged in experiential learning methods, is likely to be more enthusiastic in the classroom, creating a positive atmosphere in which students are encouraged to learn in a nurturing and enjoyable environment.

2.3 Gender in the Field of Mathematics

In a discussion of gender and mathematical skill, Sax, et. al define mathematical self-concept as one's perceived mathematical ability based on social factors and academic achievement in their 2015 publication.[26] One's mathematical self-concept is "considered an important predictor of the pursuit of science, technology, engineering, and math (STEM) fields."[26] Traditionally, women have a lower mathematical self-concept; thus there are fewer women working in STEM fields. Additionally, the masculinity associated with STEM classrooms create an environment that is "male-normed, highly impersonal, and individualistic."[23] These common masculine associations draw women away from mathematics.

Mathematical self-concept is largely shaped by the stereotypes and expectations of gender roles. A 2011 study published by The College Board noted, "in high-stakes testing situations, such as the Scholastic Assessment Test (SAT) or the Graduate Record Exam (GRE), women continue to underperform relative to men on the quantitative sections".[27] This underperformance is likely the result of "stereotype threat," the idea that one's poor performance will be directly linked to a "negative group-relevant stereotype."[27] Stereotype threat has created a self-fulfilling prophecy for many women in STEM fields. Our culture anticipates women performing poorly in STEM disciplines as compared to men. Shaffer, Marx, and Prislin argue that the gender performance gap stems from the stereotype that women do not perform adequately in STEM fields.

This is a pattern that has been pervasive for many years in all categories of STEM employment.[26] It is important to note that while one's mathematical self-concept can be shaped, in part, by one's achievement in math classes, it refers specifically to an individual's perception of one's own ability, rather than an outside impression of the individual. A low mathematical self-concept in grade school, Sax explains, leads to a reduced likelihood of majoring in the STEM fields in college. Additionally, Catsambis notes, "beginning in middle school, girls have less interest in mathematics and science and have more negative attitudes towards these fields."[3] This is largely the result of high levels of social pressure and the associated performance anxiety. Traditionally low mathematical self-concept in girls, a "phenomenon known as the confidence gap" which develops in middle school,[25] comes from the American norm that STEM fields are masculine, and "girls, especially smart girls, learn to underestimate their ability" at a young age.[26] This idea is internalized and results in fewer women entering STEM fields at a post-secondary educational and professional level.

2.4 Race and Class Identities in Education

In addition to gender inequality in the field of mathematics, other minority identities are disproportionately represented. On average, African American and Latino students tend to have a more positive attitude toward mathematics than white students but they have lower levels of achievement.[3] Given a sample of fifty three percent of the nation's Expeditionary Learning schools, it was found that they are more likely to enroll Hispanic students over white students. Additionally, Expeditionary Learning has a significant impact on student achievement in math, as explained in Ira Nichols-Barrer and Joshua Haimson's work on academic involvement in Expeditionary Learning middle schools.[22] So, while minority races traditionally perform poorly in mathematics as compared to individuals of majority races, some experiential learning models may be an aid in overcoming the disparity.

In another study addressing Outward Bound's Expeditionary Learning model, which holds many overlapping qualities with the experiential learning model, author Brigid Moira Burke explains that learning should "bring together people from different social classes in common pursuits leading to self-discovery and service to others."[2] Education provides the opportunity for multiple cultures to share and receive knowledge. "Students must respect one another and be willing to understand and appreciate differences among classmates and other cultures," Burke explains.[2] Expeditionary and experiential learning provide a means by which students can engage in course material in a way that can directly relate to their lived experiences, while also learning about the lived experiences of their peers.

2.5 Criticisms of Experiential Learning

Many current education models view experiential learning as a hindrance because it decreases the number of hours students spend directly studying course materials for tests. Furthermore, it requires additional planning and preparation from the teachers.[5] In an experiential learning setting, the majority of class time is devoted to group collaboration rather than lectures and discussion. This requires students to spend additional time outside of class learning the theory and academic context behind the experiential work they are completing in class.[6] On one hand,

this can be detrimental because the teachers do not have control over the specific means by which students learn these concepts. Additionally, the efficacy of the in-class activities relies on students' self-motivation to complete the contextual work outside of class. However, in an experiential setting, students are more likely to show interest in the topics, and thus self-motivation to learn outside of class is more easily obtained.[6] Hamer notes that active learning is not well suited for large class sizes because it is often not feasible for an instructor to facilitate group interaction or hands-on step-by-step projects.[8] In most cases in the K-12 school setting, even large class are still manageable for some experiential learning techniques to be adopted, even if a full pedagogical transition is not possible.

Assuming the known conceptualized understanding of experiential learning, this research aims to address the teaching technique within the context of middle school math classrooms. Previous research has shown that students often struggle to stay engaged in mathematics classes in the traditional lecture style environment.[8] Social factors have also pointed to additional difficulty for women and minorities in the field of mathematics.[3] Through a qualitative examination of experiential learning in middle school math classrooms, this sociologically informed research will analyze experiential learning as a technique for increasing all student enjoyment, comprehension, and confidence in middle school math classrooms.

3. Methods

The goal of this research is to identify possible ways in which experiential learning enhances student engagement and comprehension in mathematics at the middle school level while also considering other factors that could also impact these outcomes. This topic was investigated through qualitative, cross-sectional interviews with teachers in traditional public, public charter, and private schools in Buncombe County, North Carolina.

The participating schools were a combination of traditional public, charter public, and private middle schools. Traditional public schools are schools that receive all funding from district, state, and federal funds. They are standardized with other schools in the district and follow state standards and testing policies. Traditional public schools are free and open to any student in the district. Public charter schools also receive funds from the state but these funds are allotted on a per-pupil basis. Charter schools also rely on funding from donors. Charter schools are open to any student but may not provide transportation to all students. While charter schools follow state standards, they have fewer requirements in the realm of standardization and student testing. Private schools do not receive state funding, but rather rely solely on student tuition costs, funding from an organization such as an associated church, or private donors. Private schools are not held to state standards or testing requirements, though many use state standards as a guide in their instruction. Most private schools have an application process and some offer tuition scholarships.

The participating teachers all taught at a traditional public, public charter, or private school and they all taught middle school mathematics. Middle school includes sixth, seventh, and eighth grades, and students usually range from age eleven to age fourteen. Most teachers specialize in one specific grade in the sixth through eighth grade range but all teachers are qualified to teach all three grades in their school. Including traditional public, public charter, and private school teachers in the study creates variation in school funding, student and teacher demographics, and state and privatized testing standards.

At the beginning of the interview, teachers were asked to define experiential learning as they were familiar with the concept. Thus, the exact definition of the concept varied. In all cases, participants described experiential learning as a combination of four key components: student directed learning, hands-on application of concepts, group or partner collaboration, and frequent feedback, reflection, and revision.

Teachers measured student comprehension through formative and summative assessments. Formative assessments are informal and low stakes and may include classwork, homework, observations, and engagement in class or group conversation. Summative assessments are a more formal means of gauging understanding and they usually occur at the end of a unit or semester, often taking the form of an exam or project.

Teachers gauged student engagement through their projected enthusiasm in class, growth from previous years in math class, and their self-confidence concerning math assignments. To gather data regarding these measures, teachers were asked about their class practices and students. Some of the key questions in the interview guide included:

1. How do you define experiential learning?
2. Do you incorporate experiential learning in your classroom? Why and how?
3. How do you structure your homework assignments and assessments?
4. What advantages do you see in experiential learning overall and in a math classroom specifically?
5. What are some downfalls that you see in the experiential learning model?

6. Do you notice any differences in how students respond to experiential learning based on the race, gender, academic success, or socioeconomic status?

A complete interview guide is available by request.

These questions were used to understand the ways teachers incorporate experiential learning into their classroom and to gauge the extent to which teachers think these methods are effective in gaining and maintaining student interest as well as measuring student comprehension. Other questions regarding teacher morale, teacher/student relationships, and teachers' inspiration were also included. Additional demographic-based information about the teachers was submitted through an online questionnaire prior to the interview.

Schools were selected through a quota sample to ensure inclusion of different types of schools. The study was limited to middle school math teachers in Buncombe County. According to 2016 reports from the Asheville Chamber of Commerce, the average SAT scores of public school students in Buncombe County is close to, and slightly above the North Carolina state average, suggesting Buncombe County's student population is similar to the greater North Carolina student population.[1] The number of students eligible for free or reduced lunch in Buncombe County Schools was also comparable to the statewide figures. This suggests Buncombe County is has a similar representation of students as other school systems in North Carolina.

Based on data from July 2016, Buncombe County Schools estimates a total of 25,597 students enrolled in public schools in the district. Of these 25,597, the National Center for Education Statistics estimates approximately 7,000 students attends public and charter middle schools and an additional 3,173 attend private schools. These 10,173 students are spread across 29 recognized private schools, eight traditional middle schools, and four charter schools.[9]

Of the eight traditional middle schools, four were contacted to participate. All four charter schools and five of the 29 private schools were contacted to participate. Selection of schools was limited to Buncombe County because of their proximity to the researcher's location. Contact began through communication with principals and executive directors at these thirteen schools to obtain permission to reach out to the teachers. After permission was obtained from the principal of each school, the middle school math teachers were contacted directly at their respective schools. When contacted, teachers were informed that they would be asked questions regarding their teaching style and views of varying pedagogies but were assured no individually identifying information nor student specific questions would be asked. From there, ten teachers who were willing to participate in an interview returned communication. Most participating teachers work with seventh and eighth grade students. The teachers who worked with sixth grade students also worked with seventh and eighth grade students.

Most interviews were early in the morning before students arrived at school. This was helpful because teachers were not fatigued from a day of working with students, and were eager to discuss their classroom styles with a college-aged researcher. No incentive was offered to participants. Interviews were conducted in-person with the exception of two conducted over phone due to scheduling conflicts. The interviews were conducted in teachers' classrooms which created a comfortable and safe environment in which the teachers were honest regarding their praise and criticisms of both the education systems and their own teaching.

Two phases of coding, "open coding" and "focused coding" produced a condensed list of ten themes, divided into three frames.[21] Frame one, Experiential Learning is divided into three themes: (1) Definitions, which addresses any definitional descriptions of experiential learning, (2) Advantages, which addresses mention of advantages of experiential learning to students and teachers, and (3) Disadvantages, which addresses any disadvantages of experiential learning to students and teachers discussed by the participants. Frame two, Student Engagement, was divided into four themes: (1) Comprehension, which addresses any discussion of ways in which experiential learning assists in helping students understand mathematical concepts, (2) Enjoyment, which addresses observations of student excitement and enjoyment in a classroom setting, (3) Confidence, which is noted in any mention of student self-confidence, self-concept, or mathematical self-concept development in the classroom, and (4) Demographics, which addresses conversations of student engagement as related to race, gender, socioeconomic status, and academic excellence. The final frame addressed is Teacher Engagement. Teacher Engagement is divided into three themes: (1) Morale, which includes discussion of teacher attitude, interest, and excitement in the classroom, (2) Relationships, which includes discussion of teachers' relationships with their students, and (3) Goals, which includes discussion of the goals teachers have for their students upon leaving their classroom. An example of the code book can be found in Figure 1. A full code book can be obtained upon request.

Theme	Thematic Description	Representative Quote
Experiential Learning: Definitions	Definitional descriptions of experiential learning	"encompasses many subject areas with an authentic piece" "teacher's role shifts from a teacher to a facilitator of learning that supports/mentors students as they learn" "student directed learning"
Student Engagement: Comprehension	Ways in which experiential learning assists in helping students understand mathematical concepts	"kids learn from their own work" "experiential learning in math allows them to learn to fix their mistakes rather than just trying to get the right answer; that's where you learn math"
Teacher Engagement: Morale	Teacher attitude, interest, morale, or engagement in the classroom	"helps design projects and keeps me interested in teaching math" "helps teacher enthusiasm"

Figure 1. Sample of experiential learning interview code book.

4. Findings

4.1 Demographics of Participants

Of the ten teachers interviewed, four worked in public charter schools, three worked in traditional public schools, and three worked in private schools. Every teacher had taught for a minimum of five years, and six teachers had taught for more than ten years. While this was not a criterion for sample selection, it is important to note that all teachers willing to participate had moderate teaching experience. Nine of the participating teachers were female and one was male. This follows the common patterns of education being a female-dominated field. The average class size of the charter schools was twenty two students, the average class size of the traditional public schools was twenty three, and the average class size of the private schools was fourteen. While charter and traditional public schools have comparable class sizes, the private schools studied had a notably smaller class size. All of the private school teachers explained that their grades were more integrated than the public schools. More specifically, two teachers described their classroom setup which includes classes that combine seventh and eighth grade students. They noted this arrangement allows for more peer-to-peer teaching.

When asked for an estimate of class time spent in an experiential learning setting, participants answers varied from ten percent to fifty percent. Slightly differing definitions of experiential learning could account for some of this variation. All teachers noted that the amount of experiential learning they incorporated into each lesson was dependent upon the topic and often changed from unit to unit. For example, teachers explained geometry projects that worked well with experiential learning and expressed difficulty in finding relatable algebra projects. Regardless of class size and percentage of time spent using experiential learning techniques, all teachers were familiar with and included experiential learning into their lessons.

4.2 Experiential Learning

Specific conceptual understandings of experiential learning varied slightly among teachers when directly asked to define the concept. One teacher described the teaching style as “presenting students with a problem that they encounter outside the classroom and teaching them how to solve the problem with the tools they gather in the classroom.”[19] In this explanation of experiential learning, the teacher described outside examples as means for creating word problems. Four other teachers described similar philosophies. An experienced public school explained her use of illustrative math problems as a way to incorporate experiential learning into the common core standards.[14]

Four teachers described experiential learning as an application of mathematical concepts to real world situations. One of these teachers defined experiential learning as “getting out of the classroom and relating math to the real

world."[16] This explanation of experiential learning physically moves the students out of the classroom and into the environment in which they are using the mathematical skills. An example this teacher gave for an experiential learning activity is an activity that measured the height of their school based on the length of the shadow and the distance between the student and the structure. In this activity, students were asked to use the pythagorean theorem to determine the lengths of the triangle created by their height and their shadow. Then given this measurement, and their understanding of similar triangles, they were then instructed to measure the length of their school building's shadow and determine the height of the building.

Teachers frequently noted the use of manipulatives as a common bridge between word problems and activities outside the classroom. Manipulatives are tools that can be used in a classroom to add a kinesthetic component to a lecture-style lesson. One teacher used the example of red and white chips that students could move around on their desk as they learn to add and subtract integers.[17] "The red chips represent negative integers and the white chips represent positive integers," the teacher explained. This allows students to have a physical tool at their desks to understand a fairly abstract concept.

Definitions of experiential learning frequently included references to student directed learning and teacher facilitation. A teacher described a class arrangement as following the form: students attempt problem individually, groups of students tackle problem together, the class collaborates as a whole with teacher assistance, groups of students tackle a similar problem, and finally students attempt the similar problem individually.[10] The teacher noted this format allows the students to "grapple" with a problem individually and with classmates before any direct instruction from the teacher occurs. This leads to more student directed learning and allows the student to determine both the process and the answer, the teacher explained. Additionally it allows students to engage in active group discussion and analyze mistakes. Further application of student directed learning will be addressed in the discussion of the advantages of experiential learning.

A common theme in general dialogue of experiential learning is discussion of advantages and disadvantages of the model. Most teachers noted wide-ranging examples of advantages for both students and teachers. One teacher noted, "using experiential learning makes word problems more approachable. It is much easier when [the students] can visualize it."[10] Many teachers expressed similar sentiments. Of the ten teachers interviewed, six teachers said that experiential learning activities help students become and stay engaged in the course material. In reflecting upon engagement, another teacher said, students build more conceptual understanding and are able to learn more effectively from their peers. Teachers also noted that increased confidence of their students appears to be connected to engagement in the classroom.[12] Experiential learning encourages group and partner assignments which improves communication skills. One teacher, whose explanation of experiential learning was largely technologically based, noted, "technology is how this generation knows how to communicate and education is communicating."[14] Communicating in group collaboration setting and conveying ideas of critical thinking are two themes many math teachers struggle to incorporate into their classrooms, but this teacher argued that a math classroom is a perfect place to stress these skills and experiential learning is an effective means of doing so.

While experiential learning has many advantages in the classroom, all ten teachers expressed concerns about three main disadvantages. Most prominent of disadvantages expressed in the interviews was that experiential learning activities take more planning and preparation time. For each experiential activity, teachers must spend time planning, collecting materials, preparing, and cleaning up after each class period. Many teachers expressed concerns that this takes time and material to which they do not always have access.

Additional difficulty sometimes arises during the class period. With many students working individually or in a small group on a project, teachers must engage with a busy classroom. One teacher described the atmosphere as "organized chaos," noting that organized chaos can quickly get out of hand if a teacher is not equipped to manage all of their students.[15] This disadvantage is very number-driven. Teachers with smaller class sizes, often in private schools, have fewer students to assist on an individual level during an experience. While class size could be a factor in classroom management, a teacher with fourteen students expressed similar concerns. Regardless of the number of students in a class, experiential learning can create a difficult classroom atmosphere to navigate.

Some activities that require a large amount of planning may also only cover one topic or standard. One public charter school teacher noted that while a project may seem really engaging when planning first occurs, the time spent preparing for and completing the activity is not worth it in the long run. It is challenging to find projects that are relevant to the course material and address multiple learning targets, while also effectively assessing a student's progress in the course.[17] Six of the seven public school and public charter school teachers addressed keeping up with the curriculum as a challenge of using experiential learning in the classroom. This was not a concern mentioned by any of the three private school teachers. Two of the teachers in the private school noted that they appreciated being able to frame their course based on a "deep understanding of concepts" rather than solely teaching for the test.[12] One public school teacher noted the most success she had with incorporating experiential learning projects into her course

was when she could create assignments that may take multiple class periods but that could assess multiple standards. Even if there is a great project, completing it with care and precision can be difficult for students in small period of time, a teacher explained in discussing her class duration.[11] Despite the challenges, the same teacher noted she "would never go back to a lecture style classroom."[11]

4.3 Student Engagement

Most teachers agreed that one of the main functions of mathematics classes is for the students to learn math skills. Through the self-directed learning approach of experiential learning, students are able to learn math contextually, giving them more of an opportunity to apply concepts to better grasp abstract ideas. A teacher explained this as "contextualizing the curriculum," saying that when you use relatable material to learn the process of analyzing and solving word problems, it makes them more approachable and easier when they are solving word problems unrelated to students' lives because the students now have the tools to visualize it.[10] Furthermore, another teacher noted, experiential learning brings real life scenarios to math and shows the students how they will use math in their daily life.[18] One charter school teacher, who was well-versed in experiential education, recalled the students in class explaining that experiential learning creates a tangible means by which a student can apply an abstract mathematical idea, "drives the concept home" in a way that will stick with students.[10] In describing student comprehension, a public school teacher expressed her frustration with memorization techniques like songs or tricks because while students may temporarily remember the process to solve a problem, they have no context in which to ground the idea.[19] Without some sort of relatable grounding, the tricks become one more thing for the students to memorize and recall.

One of the most important steps in the knowledge acquisition process is making mistakes and learning from them. One teacher said, "experiential learning in math allows students to find and fix their mistakes rather than just trying to get the right answer; that's where you learn math."[12] All ten participants mentioned some form of mistake revision embedded in their teaching philosophy, in the form of test corrections, homework remediation, and group discussion of errors. One teacher even mentioned that he appreciates when students correct his mistakes on the whiteboard because it opens the classroom to an environment in which helping each other through mistakes is encouraged and supported.[10] As discussed further in regards to teacher relationships with students, many teachers noted they hope to create relationships that encourage students to feel open and accepting of their own and others' mistakes.

Learning from one's own mistakes and the mistakes of their peers, fosters a classroom environment in which students are learning from each other. This creates an atmosphere in which teachers facilitate learning, but the majority of the learning comes from peer-to-peer interactions. A teacher noted that students learn more from their peers than from their teacher because they are better able to relate to one another.[11] Additionally, by helping one student understand a concept, another student is able to test their own comprehension. A prominent component of finding and analyzing mistakes is critical thinking and problem solving. Three teachers explained that an important part of teaching young students math is helping them cultivate an ability to problem solve on their own. This individual problem solving is a skill students must have to be successful in upper level math classes and in high school more generally.[13] Teachers encourage students to problem solve independently and in groups before coming to the teacher with questions to acquire these problem solving skills. One teacher reflected on the experience of watching students problem solve, saying she loves to watch the students "light bulbs go off when they can discover on their own."[16] The "light bulbs" of understanding also includes some component of satisfaction and enjoyment from the student.

Many teachers expressed appreciation for experiential learning because it generates an environment in which students enjoy learning and enjoy working with mathematics. An experiential learning setting lets students do something in the classroom rather than watching a lecture and taking notes. Five teachers noted experiential learning creates a "buy-in" from the students and six teachers explain that in addition to buy in, experiential learning keeps students engaged for longer. One teacher explained a project she is working on with her seventh graders that relates to her unit on loans and interest. She instructed the students to research cars and as a class, they looked at purchasing cars and the loans and interest associated with such a large purchase. She exclaims, "I am letting the kids 'buy' expensive cars; they love it!"[18] The teacher also explained that as part of the unit, she brings in a guest presenter from a local bank to speak with the students about loans. These were supplements to her whiteboard-lesson on interest and the associated formulas. This teacher, as many of the participants explained, combines traditional lecture-style lessons with experiential components that encouraged student participation. Such model allows for the teachers to share formulas and computational procedures before allowing students to jump into a project "that is authentic"[18] and "meaningful to them."[12] If students are excited about the topics they are studying, they are more likely to ask questions and dig deeper into course material.

Six teachers noted they strive to create a classroom environment that encourages curiosity and asking questions. While this will be discussed further under Teacher Engagement, it is important to draw the connection between enjoyment and curiosity. If students are enjoying the course material and are actively engaged in the topic, they are more likely to dive deeper into the subject, asking questions and own independent research. Another teacher notes, "experiential learning is a great way to engage students who have otherwise shut down at school."[15] For students who struggle to stay focused in school, providing an avenue for them to connect their schoolwork to their lives outside of school leads to a deeper appreciation of the course material.

Four teachers described middle school as a stepping stone into high school. At this turning point in students' lives, teachers are presented with a prime time to get them engaged and excited about learning in preparation for high school and college. One teacher explained that she thinks getting students excited about math in middle school will make it more likely they will remain engaged, excited, and successful in high school.[16] Providing relatable material to students creates an opportunity for students to see how the topics could directly help them reach other social and educational goals.

A necessary component of reaching social and educational goals is having confidence in one's work and knowledge. In education of mathematics, this idea is often referred to as mathematical self-concept, which is the belief that one can succeed in understanding math content. One teacher explained that so many of her students begin the school year thinking "they are stupid when it comes to math."[11] Her response is always "you're not stupid, you just have not learned it yet." She hoped by the end of their time in her classroom, her students would understand that given the right tools and support, they can succeed. Many teachers explained they hoped students would gain confidence by creating a space for open dialogue, in which students are able to speak up, ask questions, and in group-work settings, emerge as leaders. In many cases, the students that are seen emerging as leaders are ones who were feeling silenced in former classroom settings.[13] Practicing these three indispensable skills enhances character development and prepares students to be confident critical thinkers in other aspects of their life.[16]

Many teachers commented on the student-directed learning aspect of experiential learning as playing a key role in increasing confidence in students. Student-directed learning provides space for students to make mistakes, self-reflect, and ask questions in a safe classroom atmosphere. Allowing time for self-reflection gives teachers a chance to "meet students where they are" and give them individualized tools to boost their self-confidence. By giving students a topic and allowing them to explore it in their own way, teachers "empower kids to develop their own questions and meet with people in their own community to explore those," said one teacher of her experiential learning approach.[13] She went on to explain that she believes "mathematical self-concept can increase with a shift from memorization to experiential learning."[13] Ideas of self-discovery and self-confidence in mathematics are deeply rooted in student demographics.

All ten teachers addressed gender, race, age, and socioeconomic status as factors in students' comprehension, enjoyment, and confidence in mathematics through experiential learning. It was a consensus among all ten teachers that experiential learning benefits students regardless of any demographic factors.

When asked if it benefits a specific age range more than others, one public school teacher noted that experiential learning begins at birth, and we learn and grow through the baby years through exploring the world around us. Therefore, experiential learning should remain an integral part of education through all grades.[15] In regards to age, a public charter school teacher explained that it can be difficult to incorporate experiential learning into a middle school classroom if students are unaccustomed to a similar style of teaching in elementary schools; however, this teacher believes it should be integrated into teaching earlier rather than removing it from middle schools.[11] Another teacher explained that experiential learning should be present in classrooms regardless of grade, but that the implementation of the teaching techniques will differ. For example, a discussion or debate style lesson may be more engaging to a high school class while a middle school class may enjoy a three-dimensional art project.[10] Three other teachers provided similar examples.

Regarding gender, three teachers explained that many middle school aged boys thrive from activity and struggle to pay attention to long presentations or lectures. For this reason, they feel incorporating movement based experiential learning can be beneficial to many of their male students. Conversely, teachers agreed that many middle school aged girls thrive in leadership and performance roles. One charter school teacher provided an example of such an activity known as an "informance" in which students are given a topic and create an informational skit or song based on the topic to present to the class.[17]

The most prominent factor in success or difficulty with experiential learning that participants addressed was regarding academic achievement level. Two teachers noted that some experiential learning activities, especially art based projects, create an environment in which low achieving students can hide their lack of understanding behind their artistic creation.[17] Opposing views suggest that some experiential learning contexts can be useful for students struggling in math classes because they provide an environment that allows teachers to give students individualized

attention.[12] In relation to high achieving students, similar contrasting views were expressed. On one hand, a teacher explained, high achieving students often ask for the quickest and simplest path of learning which is often a lecture and worksheets instead of experiential learning.[17] However, experiential learning activities can also be a great tool to encourage the high achieving students to dive deeper into a concept and address it more critically.

No teacher addressed race or ethnicity as a freestanding factor, but many addressed the intersectionality of race with socioeconomic status, gender, and academic achievement. However, six teachers addressed the importance of creating experiences and activities to which all students can relate. Returning to the idea of engagement, one teacher noted, "if they cannot relate to the problem you are presenting them with given their background, it is pointless and they will have no reason to engage."[19] However, it is unrealistic that each experience will be engaging to every student. "Dynamic lessons with a wide scope can benefit all students in some way and thus produces the most growth classwide," a teacher concluded.[14] Especially in large, diverse classrooms, teachers must be aware of their students' social location through building relationships with the students and being engaged in the classroom.

4.4 Teacher Engagement

Each teacher had distinct and specific goals for their classroom and students. Some common themes included creative thinking, self discovery, confidence building, and understanding mathematical concepts. All of these themes are also components of experiential learning. While some teachers were unable to explicitly define experiential learning, it was clear that many of their goals and teaching styles inadvertently mirrored experiential learning techniques. Overall, the main goal for most of the public school participating teachers was student comprehension in mathematics, directly associated with the end-of-year standardized testing. Conversely, while the teachers in private schools also stressed comprehension, they also emphasized building confidence. All teachers, regardless of school classification noted a desire to encourage student directed learning, and they addressed experiential learning as a successful means of instigating the facilitator role of teachers in that process.

Teachers discussed experiential learning as a means of increasing faculty morale in schools. Overall, the private and charter school teachers expressed a greater perception of positive teacher morale school-wide. One teacher said, "everyone here gives 110 percent. We are coworkers, friends, and family."[16] A supportive network of teachers creates a platform for sharing ideas and projects with one another, creating a collaborative work environment. Four teachers discussed ways in which administrative staff model experiential learning in professional development settings, showing the teachers effective ways to share information in a classroom. Three of these teachers also discussed the trust the administrative team has for the teachers, giving them the autonomy to design their experiences and activities in ways they think could best individually serve their students.

While some teachers discussed the challenge with experiential learning being that it takes more time before and during class, it is also a "fun and challenging way to keep teaching lively for the teachers."[13] Teachers described discussing project ideas with their students to get their feedback before planning a lesson. This helps both the teachers remain engaged and interested in teaching math while also creating fun projects that lead to sharing of information in a format that the students are able to choose.[18] This differentiation keeps the classroom fresh for teachers and students.

One teacher commented on the astute nature of the students, noting that they frequently notice and comment when teachers appear to be unengaged in the course material. She went on to explain that especially at the middle school age, students look to their teachers to model appropriate behavior.[16] Therefore, it is crucial that teachers are enjoying and engaged in the classroom to ensure they are modeling the energy they are hoping to produce from their students.

One factor in maintaining a high morale is the relationships teachers develop with their students. All ten teachers commented on the importance of a relationship with their students. In general, the teachers working in private schools described their relationship with their students as having some familial qualities, likely attributed to the small class size. She considered her relationship as "like their mama bear."[12] One private school teacher also said that given the organization of the school, she teaches most students for seventh and eighth grade which gives even more time to develop a close bond, and that the first year serves as a "trust building block."[13] Other teachers described their relationship with students as closer to a mentorship role. One charter school teacher noted "we have fun and giggle but I am also very consistent and clear in my expectations; they know that work ethic and behavior are very important to me."[18] Other mentorship roles include an advisee program described by three teachers.

An important part of developing relationships with students and between students is creating a community in which students feel safe to fail and learn from their mistakes, a teacher explained.[19] If students are comfortable interacting with their teachers in an informal manner but are still aware of expectations, a "respectful and nurturing" relationship can form.[12] A classroom community that encourages supporting peers in learning creates a healthy atmosphere to

make and discuss mistakes so that everyone can learn from them together, which is a key component of experiential learning. As discussed previously, this educational environment can help to increase student enjoyment, comprehension, and confidence in a math classroom. A charter school teacher emphasized the importance of teachers appreciating their own mistakes in teaching as a tool in creating a "culture of learning" that stresses lifelong growth.[11] Another teacher made similar observations, remarking, "they [the students] must recognize we are all human beings in the world together learning to be better people."[12]

The community approach to teaching creates an appropriate atmosphere for teachers to check-in with their students regarding class activities. Teachers can ask students what types of projects are most meaningful to them and can get honest feedback on assignments to improve them for future classes. This open dialogue shows students that their opinions in the classroom are important to their teachers, and encourage students to confidently reflect on their work and on the assignment itself.[15] A cyclical relationship begins to form in this community, in which students and teachers are simultaneously teaching and learning from one another.

5. Implications

Findings of the interview responses of the ten participating teachers produced three large thematic results: general analysis of the experiential learning model, discussion of experiential learning as a means of student engagement, and exploration of experiential learning as a tool for teacher engagement.

Definitions of experiential learning included components of artistic expression, group discussion, student-directed learning, and tactile engagement with course materials. Experiential learning looked different to each teacher but was in every case, a combination of these components. Teachers found advantages in student enjoyment, student comprehension, and student confidence given the use of experiential learning in middle school math classrooms. Disadvantages discussed by the teachers included a larger amount of planning and preparation time for the activities, and difficulty finding projects that covered more than one objective or standard. Teachers also expressed classroom management as a difficult component of hands-on projects and activities in place of lectures.

Overall, the teachers agreed that experiential learning is beneficial for students in three main ways: for purposes of enjoyment, comprehension, and confidence. Students are able to better relate to the course material given relevant examples, and as a result, they show more enjoyment in class than in the traditional lecture style classes. Given an increased enjoyment, students are also more engaged which leads to better comprehension. They can use experiential learning techniques to apply real-world applications to abstract mathematical concepts, grounding the theories in tangible examples. Finally, student confidence increases in classroom environments that encourage sharing, discussion, and making mistakes in a welcoming and safe space. In discussion of demographic factors, the consensus among teachers was that experiential learning should be integrated into all classrooms regardless of age. They noted in general, middle school boys thrive in movement based activities, while many middle school girls thrive in the performance and art based activities. Academic achievement has both positive and negative relations with experiential learning in that high achieving students can benefit from deeper critical thinking but also often request more concrete teaching styles. Conversely, while some teachers note that low achieving students hide behind the project component of experiential learning, the teaching method allows for more individualized attention in the classroom with the students who are struggling. While race and socioeconomic status were not prominent factors, many teachers commented on the need for the activities and experiences to which be ones that students of all backgrounds can relate.

The final subject addressed in the analysis of the interview findings regards teacher engagement. The teachers' goals often align with the goal of experiential learning in that they hope students will learn math, will enjoy math, and will boost their confidence in math. The teachers also noted that staff morale is a large factor in student engagement and the fresh and creative nature of planning experiential learning lessons fosters a naturally positive attitude in many teachers. This coincides with the need for a genuine relationship with the students that aims to create a safe space for teachers and students to fail, learn from their mistakes, and learn equally from one another.

These analyses show that overall, the participants have a positive opinion of experiential learning and think it is a valuable contribution to the classroom setting. It can pose some challenges but the quantity of the benefits largely outweigh the detriments. Although they were assessed, no substantive patterns emerged in relation to the type of school at which the teachers as compared to their views on experiential learning. Further research could be beneficial in determining more specific causal relationships between experiential learning and student achievement. Some avenues for this research would be investigating standardized test scores and post-secondary achievement. Exploration within the same topic given a random sample could also be beneficial in broadening these results to a

generalizable claim. Additional consideration of regional or demographic factors could also expand the results to be more representative of the United States population.

6. Conclusion

This study supports the idea that experiential learning is a valued tool by middle school math teachers. It encourages teachers to remain engaged in creating valued course content and pushes them to develop healthy and genuine relationships with their students. Additionally, experiential learning contributes to student engagement via enjoyment, comprehension, and confidence. It does not appear that experiential learning is particularly suited for a specific demographic, but rather when appropriately relevant, can benefit all students regardless of age, gender, academic achievement, race, or socioeconomic status. Further research should examine generalizable claims regarding potential causal relationships between experiential learning, teacher engagement, and student achievement.

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