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The Impact of Altering Physical and Human Components in Middle School Mathematics Classes on Assessment Performance

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The Impact of Altering Physical and Human Components in Middle School Mathematics

Classes on Assessment Performance

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in fulfillment of final requirements for the MAED degree

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A handwritten signature in black ink, appearing to read 'V. G. ...', is written over a horizontal line.

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Abstract

This action research report explores classroom environment interventions used to improve mathematics assessment scores and the effects of anxiety on those scores. This paper identifies that to increase academic performance on math assessments, a person should consider physical and human components, whether it is within the physical movement in the classroom, teacher-student proximity, or student self-assessment (e.g., attitude, growth mindset, focus/engagement). This research also suggests that teachers and students need to be relieved of the negative effects of pressure in a school's testing culture. The conclusion gathered from this research suggests that students benefit from increased movement during assessments and from creating an environment without the use of the word "test" or the use of standardized high stakes teaching practices.

Keywords: Mathematics, Testing, Academic Performance, Academic Success, Relationships, Classroom Learning Environment, Physical Components, Human Components, Strategies, Implementation, Small Group Assessment, Student Self-Reflection, Anxiety

Everyday assessments are facilitated by educators in classrooms across the country. Assessments allow teachers to gather data on their students' mastery of a specific set of skills and are commonly given in the form of tests. Traditional testing environments require silence and are high-stakes which leads to students ultimately cramming the night before and getting stuck on one question or discouraged on the first page. Through student conversations and observations, it has been determined that students understand that tests are "important" and significantly impact their grades, leading to comments of high anxiety and intense pressure to achieve perfection on these assessments for their grades, family, or self-esteem. Student anxiety is increasing at this school with more students needing therapy services from outside resources or school therapists. My urban middle school has hired two therapists from an outside resource to meet these needs. About 20% of 5th-grade students also receive Mathematics Intervention as a specialist course to support the gaps in their mathematics abilities. While educational institutions and guardians of students rely on these test scores to better support, fund, and teach their schools and students, it becomes an increasingly important issue educators are working to address to improve student mental health and self-image.

The concern among educators and researchers regarding mathematics assessments is increasing student anxiety and students not being successful or interested in mathematical fields. As a result, negative self-perceptions in mathematics are common among students. The reduction of the student anxiety surrounding assessments could result in the increase of student knowledge and opportunities for career exploration in mathematics fields as well as increased student opportunities for participation in mathematics classes. From the findings of other classroom studies (i.e., explored in the

review of the literature), revolving around student anxiety and mathematics assessment performance, a variety of interventions were applied to two middle school mathematics classrooms in Minnesota. The interventions focused on the physical (e.g., movement, classroom layout/desk arrangement during the assessment) and human (e.g., emotional state, growth mindset, teacher-student interaction during the assessments) components in two middle school classrooms during mathematics assessments.

Educators need to discover which classroom interventions are most effective in increasing students' success on assessments. The problem I attempted to resolve was to increase academic performance on mathematics assessments for the 5th-grade mathematics students at an urban magnet middle school in Minnesota during the 2021-2022 school year. To do this, the current mathematics assessment procedures must be examined. Mathematics tests are given in one class period, often consist of multiple pages, and are administered in a very high-stakes environment which leads to students ultimately cramming the night before and getting stuck on one question or discouraged on the first page, ultimately leading to low test scores and negative self-views in regards to school success/mathematics class. Students in this study understand and express in class to teachers that tests are "important" and impact their grades a lot, leading to high anxiety and high needs to be perfect on these assessments due to family pressures, for their own grades or academic self-esteem. In connection with this feeling and understanding, student mental health is suffering. Student anxiety is increasing with more students needing therapy services from outside resources or school therapists; my participating school has hired two therapists to meet these needs. With student mathematics academic achievement on tests decreasing, mathematics intervention as a

specialist course has increased enrollment. In fact, 60% of the 5th grade mathematics students during the 2020-2021 school year were identified as “does not meet” on the state standardized mathematics test. This is an important problem to solve because students will be in high-stakes testing environments throughout their education careers.

It is also important for teachers to solve this problem as students who are struggling with mental health will be unable to accurately perform academically if their basic needs are not met. It is also important to address this because the same students continue to succeed while the same students continue to not pass mathematics assessments and classes which increases their personal biases and negative attitudes towards mathematics, specifically students of color and those that are not male. The literature gathered provides proven methods of intervention to improve mathematics assessment achievement. It also supports the statement that students need mental health services and social-emotional learning to improve academic success. The question asked as a result of this problem was, what effects will altering physical and human components of the learning environment have on students’ anxiety and scores on mathematics assessments in a fifth-grade math classroom?

Theoretical Framework

David Hargreaves’s interpersonal relations and education theory state that teachers are to provide conditions that are necessary for positive learning environments (Zandvliet et al., 2014). The required and core conditions for a positive learning environment include empathy, warmth, respect, and many others of similar nature. The theory also provides evidence that students with positive interpersonal relationships gain several positive outcomes (Zandvliet et al., 2014). Some of these outcomes include

increased motivation on daily tasks, support working through stressful situations, companionship, and social-emotional support. Interpersonal relations have been shown to increase student engagement and motivation for academic achievement. Within the classroom, the teacher can create a positive attachment with students to help support intellectual development and increase the student's self-confidence. Student behavior then becomes directed towards academic success, goal setting, and internalization of their teacher's thoughts on their abilities (Zandvliet et al., 2014). This theory was a motivating thought for teachers as interventions were planned and implemented.

The interventions focused on the physical (i.e., movement, classroom layout/desk arrangement during the assessment) and human (i.e., emotional state, growth mindset, teacher-student interaction during the assessments) components. The physical component of the learning environment that supports interpersonal relationships between students and their teacher and peers is the desk arrangement during class and assessments. Creating a desk arrangement that allows for teachers and students to spend more time in small groups increases student and teacher interaction. This increased interaction builds the relationship. Within this physical component, student interpersonal relationships were used to support the human components. This theory supported our work because we were able to allow for students to interact with the teacher more during class in a smaller setting while also allowing more opportunities for the student voice to be heard. There was also increased opportunity for the creation of the previously mentioned positive attachment between student and teacher. As the teacher works closer and more directly with the student, there are increasing opportunities for companionship and emotional support during what was previously a stressful situation. With increased

mathematics-anxiety being a problem among our students, many will not speak up in class. By placing a teacher next to the student with a reduced number of peers, students shared more and the teacher-student relationship grew stronger. Students were able to hear their teacher speak positively of their abilities as they worked through the assessment, allowing for more empathetic and warm conversations.

Review of Literature

The problem that this literacy review is trying to solve is the decrease in academic performance on mathematics assessments for the 5th-grade mathematics students at an urban middle school during the 2021-2022 school year. This literacy review aims to answer the question, what classroom interventions are most effective in increasing students' success on mathematics assessments? To do this, the current mathematics assessment procedures must be examined. Mathematics assessments are given as tests in one class period, typically several pages in length, and in a very high-stakes environment. Ultimately this leads to students cramming the night before or discouraged on the first page. As a result, students are receiving low test scores and have negative self-views in regards to school success/mathematics class. Middle school students' mathematics performance and test anxiety has an increased prevalence in my classroom. Teachers in my school district are repeatedly reporting students struggling on tests and lacking coping tools for test anxiety. These teacher observations point out a need for classroom interventions that are most effective in increasing students' success on mathematics assessments. In connection with these observations, teachers are also seeing that our students' mental health is suffering. Student anxiety is increasing with more students

needing therapy services. A large portion of the student population at my school are receiving services in and out of school.

Due to the reality of students being involved in high-stakes testing environments throughout their education careers, this problem holds importance for educators, specifically those in the mathematics department. It is also important for teachers to solve this problem as students who are struggling with mental health will be unable to accurately perform academically if their basic needs are not met. It is also important to address this because the same students continue to succeed while the same students continue to not pass mathematics assessments and classes which increases their personal biases and negative attitudes towards mathematics, specifically students of color and those that are not male identifying. This literature review examines impacts of literacy and communication skills on mathematics competency, impacts of gender on mathematics competency, learning environments, and testing cultures and pressures.

Impacts of Literacy and Communication Skills on Math Competency

The traditional classroom environment required for students to do mathematics, according to state standards, includes using language that engages students (e.g., compare, predict, investigate) and the use of verbs in mathematics teaching gets students to actively engage therefore reinforcing they are capable of doing mathematics. Imbertson (2017) combats this traditional classroom environment in her study that focused on English language learners and low-income students using talking as an intervention strategy to improve their test scores. This study included the use of the Accountable Talk strategy. This included recording their conversations and thinking in regard to the higher-level thinking questions posed to them in their mathematics practice.

Students who used this skill grew in their mathematics scores more than those who did not use the Accountable Talk strategy (Imbertson, 2017).

Impacts of Gender on Math Competency

The classroom environment required for students to do mathematics includes recognizing the impact that a student's self-view has on their capability to succeed in mathematics. According to the literature, one of the bigger factors of a student's self-view of their mathematics abilities is their gender. Huang et al. (2018) note that a decrease in academic performance on mathematics assessments can be addressed by focusing on gender. This study found that females' mathematics and science career ideas are directly impacted by their mathematics anxiety. This research supports that providing near-peer role models that students can identify with can decrease their mathematics anxiety while increasing their mathematics achievement.

Shokrgozar et al. (2019) note that their study found a decrease in academic performance on mathematics assessments can be addressed by focusing on female students' mental health diagnosis, treatment, and preventative practices. Similarly, Erturan and Jansen (2015) had the same finding for female students. Their study also found that male students tend to have lower test anxiety than female students. The study found this may be due to students' perceived mathematics competence relating to mathematics performance being significant and could influence students' emotional mathematics experiences (e.g., reacting to getting a question wrong, scoring poorly on a task in class, getting in trouble in class). Malik and Rizvi (2018) expand on the idea that increasing student knowledge and opportunities for career exploration in mathematics fields and increased student opportunities for participation. Their study notes a decrease

in academic performance on mathematics assessments can be addressed by student involvement, personal relevance, and emphasis on understanding. With multiple studies finding the same results, it becomes clear that gender has a significant impact on personal relevance and student mathematics competency.

Learning Environment - Physical and Human Components

Altering the learning environment can also impact mathematics competency.

There are two main ways a learning environment can be changed for academic improvement. Kurtulus' (2021) flow needs a balance in challenge level and skills needed. Students also need emotional engagement to obtain a flow state. Factors for flow level were only explored related to schools and the class, not out-of-school factors. In addition to student engagement and attitudes towards mathematics, student movement and flexible seating options can also be large factors when altering the classroom environment for improved academic performance in mathematics.

Mead and Scibora (2016) note that a decrease in academic performance on mathematics assessments can be addressed by making sure students are not sedentary during mathematics class time. In this study of three 6th grade mathematics classes in Minnesota, the classrooms that used two five-minute physical exercise breaks during one mathematics period throughout the course performed higher than students with no physical exercise on mathematics tests. However, the study also found that students who were able to use stability balls throughout the entire duration of the class period were exposed to more movement and performed the best on the mathematics tests (Mead & Scibora, 2016).

Testing Culture and Pressures

An additional consideration when reviewing interventions for mathematics competency is the result of our state and nation's testing culture and the pressures that result. Smith & Holloway (2020) note that a decrease in academic performance on mathematics assessments can be addressed by reviewing the negative effects of pressure in a school's testing culture on teacher appraisal and evaluation. Their recommendation was that assessments should be used for providing teachers and students with feedback not for judging a teacher's work. They also suggested that the result of this culture is creating teacher shortages and burnout due to the intensity of the test.

Another consideration of the testing culture is how assessments are given to students. Cassady & Gridley (2005) completed a study focused on undergraduate students and found that online tests posed a lower threat, especially in terms of formative assessments before summative assessments. The meaningful result from this study was that paper tests create conditions for the highest student-perceived test threat. Some important questions to come from this study are; are we using this to justify our online tests now for standardized testing? Did distance learning during the 2019-2020 and 2020-2021 COVID-19 pandemic teaching and learning change this perception for students who were used to in-person learning? Has technology changed enough since this study in 2005 to change these results? As schools move back to in person learning and continuing to administer standardized tests, there is cause for concern about the pressures and negative impacts of the testing culture that has been created.

Summary

It appears there is a common understanding that to decrease academic performance on mathematics assessments, a person should consider physical and human components. Physical movement in the classroom, teacher-student relationship, student self-assessment (e.g., attitude, growth mindset, focus/engagement) should increase while recognizing student demographics (e.g., ELL, gender, mental health) will impact student academic performance.

Methodology

The population for this action research study was fifth-grade students enrolled at an urban middle school in Minnesota. A total of six classes of 160 students in total were assessed using alternative testing environments and Approach 1 students were surveyed after each studied assessment (Appendix A). The demographics of students attending in the academic school year 2021-2022 include 45% white, 35% Hispanic, the last 20% is a mixture of African American, multiracial, and Asian, with 49% female and 51% male. During the summer of 2017, I was hired as a 5th grade mathematics teacher. I continued to teach in that position for three years. During the spring of 2020, as we started navigating distance learning for the first time, I could feel the anxiety in myself and my students increasing. During our distance learning that spring I also learned I would not be back in that position the following year. I ended up teaching 1st grade at an elementary school nearby for the 2020-2021 school year. During that year, I experienced small group teaching and assessing that I hadn't used since student teaching. This experience created a curiosity among myself and my peer coach as she observed me in a new teaching environment. Following that year, I was welcomed back to my old position

back in 5th-grade mathematics. With my return, I decided to explore the possibility of modifying the mathematics testing environment. I have taught with the district mandated math curriculum for five years now (i.e., four years with 5th-grade material and one year with 1st-grade material). This has been the district's chosen curriculum since 2017 when I started. I began working with this group of participants at the beginning of the 2021-2022 academic school year. Through conversations with other teachers (grade levels kindergarten through eighth) in the area, I was able to conclude that the majority of them had observed an increase in student anxiety since the switch to distance learning and the mathematics scores were decreasing. As a fifth-year white and female mathematics teacher, I felt it was important to create an action research project that would support the students in the mathematics classroom using my new experiences in a younger grade to guide the process.

In September of 2021, all families received a letter of consent for their student's mathematics scores and responses to be used for this research. The letter was translated into Spanish for the many families who need that and offered in any other language necessary for students and their families. Only three student's families chose to opt-out of the data collection.

To increase student academic performance on mathematics assessments while decreasing their anxiety, this study used a mixed design with a combination of qualitative and quantitative data collection (i.e., teacher-made assessments, teacher journals, student survey responses, and standardized tests). Data collection included assessments that were used in two different formats to utilize two different approaches; small group testing and movement during an assessment. Three of the studied classes received the assessment in

the form of small group instruction while the other three classes received the same assessment one question at a time around the room. The same assessments were used for both approaches after teaching the same lessons and activities over the same amount of time. Assessments included teacher modified versions of the Chapter 1, 2, and 3 district mandated curriculum assessments. Chapter lessons varied from six to nine lessons depending on the chapter. Each lesson was taught for one to three days with whole group instruction with notes and a variety of classroom activities (worksheets, district-provided mathematics apps, hands-on activities, etc.). Lessons and activities lasted almost a month, reserving the last week of the month for review and assessment. All students received one to two days to complete a review worksheet created to match the assessment format/question style on the days leading up to the assessment. The assessments varied from 14 to 17 questions but remained one page, front, and back. Each assessment included one vocabulary matching question, true-false questions, word problems, and operational questions. Students were provided two consecutive classes (55 minutes each) to complete the assessment. If necessary, students were able to continue as long as needed one on one with the teacher until it was completed. Only one assessment was completed per month between October and December of 2021.

Students who completed small group (four students) assessments completed one page a day with teacher feedback and support readily available at a small group table. When students were not in small groups, they worked independently on the skills being assessed creating noise and action in the classroom. These students were surveyed three times (once after each chapter assessment) on a seven question Google Form (Appendix B). The seven questions included two multiple choice questions, three short answer

questions, and two linear scale questions. Surveyed students were asked to reflect on the non-traditional testing environment they had just experienced and rank their levels of anxiety during the assessment. Students were specifically asked per assessment how successful they viewed themselves based on the format of the assessment. Students who completed the assessment while moving around the classroom completed a method the teachers created called “Math Museum”. This method was used to increase student engagement and movement during the assessment. Students would move around the room to one question of the assessment of their choice at a time while recording on the same assessment page as those that completed it in small groups. The posted questions included QR codes for students to scan with the aid of their iPads and headphones to hear the questions read in English or Spanish. This environment maintained a quiet environment while the small group assessment did not. The 5th-grade mathematics teachers in the Math Museum setting circulated the classroom identifying students who needed additional support.

The 5th-grade mathematics teachers reviewed and corrected the paper assessments for the students' scores. Small group teachers included a 5th-grade mathematics teacher and the curriculum director of that middle school. Together they reviewed the student survey responses (Appendix B) to make additional adaptations for specific students during the next small group assessment when needed. Small group teachers also conferred after each class completed the assessment on what was seen, heard, and wondered, as students worked through their groups as both teachers did not see every student each time. These observations were recorded in a teacher's journal (Appendix A). Math Museum teachers included another 5th grade mathematics teacher

and two co-teachers (one for Special Education and one for Mathematics Intervention). Together they monitored student progress through the questions and supported those that were moving slower than one page per day.

Teachers within this research were able to manipulate the physical environment of a mathematics test by changing the format of the assessment or the desk layout and teacher proximity to those being assessed. Teachers within this research were also able to manipulate the human components in a classroom, such as increasing opportunities for conversation during assessment and changing the amount of movement in the classroom as assessments occurred.

Data Analysis

The purpose of this study was to find if altering the physical and human components of the mathematics classroom would impact students' mathematics assessment scores. The research design includes three curriculum assessment scores, two standardized district assessment scores, student self-reflection forms, and teacher journals.

The quantitative data collected includes student scores from the fall and winter district standardized assessment and from the teacher-made summative chapter assessments based on the curriculum assessments. Students were assessed in the Fall and Winter of the 2021-2022 academic school year using the district standardized assessment. Student scores demonstrated mathematics understanding on the grade-level mathematics test in a testing environment that was not allowed to be manipulated due to district testing guidelines. The quantitative data of scores were compared using the fall as the pre and the winter as the post. Students were assessed with teacher-made summative chapter

assessments derived from the district mandated curriculum. The assessments included: Chapter 1 Properties, Multiplication, and Order of Operations; Chapter 2 Division; and Chapter 3 Decimals. The quantitative data of scores were compared using two different classroom environment interventions. Student success on the environment manipulated chapter assessments were also compared to their success on the standardized assessment in the traditional high stakes testing environment.

Qualitative data was collected through the use of student self-reflection forms to gather information from students if the interventions had impacted their attitude going into the assessments and their perspective of themselves as successful mathematicians. Teacher journals to describe what was observed, heard, and wondered throughout each assessment were also collected in the form of qualitative data to record the additional effects of altering the physical and human components of the assessment environment.

Table 1 shows district mandated curriculum assessment average percentages for the three observed assessments in the two alternative classroom environment approaches. Approach One was where students were arranged into small group pods of four to six students. Approach Two was students moving for the duration of the assessment around the room in “Math Museums.” Students within approach one averaged 84% on chapter assessments (given only after the material was taught) within this method of assessment. Students within approach two averaged 77% on the assessments within the “Math Museum” method for assessments. There is a decrease in the average score percentage for Approach Two on the Chapter 2 assessment. During the time of the assessment, the classroom teacher was unexpectedly out sick during the assessment days. The “Math Museum” format was operated by substitute teachers who were not familiar with this

format of assessing. Approach One classes have increased the average assessment score of each of the assessments as historically observed by the teachers. Approach Two classes increased the average assessment score on Chapters 1 and 3 as historically observed.

Table 1

Classroom Curriculum Assessment Percentages

Classroom Approach	Intervention Applied	District Mandated Curriculum Assessment	Average Percent
1	Small Group Testing	Chapter 1: Place Value, Properties, Multiplication, Order of Operations	83%
		Chapter 2: Division	83%
		Chapter 3: Decimals	87%
2	Math Museum	Chapter 1: Place Value, Properties, Multiplication, Order of Operations	78%
		Chapter 2: Division	68%
		Chapter 3: Decimals	86%

Table 2 includes the scaled score breakdowns of each benchmark for the district required standardized assessment. This table is used to determine the risk level of student groups in Table 3. *High Risk* students are below grade level and require additional interventions such as additional reading and mathematics courses. *Some Risk* identifies students who are slightly below grade level. *Low Risk* scores mean students are at grade level and the *College Pathway* identifies students who are above grade level skills.

College Pathway has since been changed to “Lowest Risk” as the company received negative feedback from teachers that naming scores that are exceeding “college pathway” and all others “risk levels” would be confusing to families and have negative implications. This assessment tool calculates student knowledge and growth through the use of common core standards. There are readings and mathematics assessments along with intervention screening tools available. As students test throughout the year (fall, winter, spring) their growth in reading and mathematics is assessed and predicted for future assessments. As students continue to test throughout the academic year, the benchmark goal scores at each level increase.

Table 2

District Standardized Assessment Benchmark Scored Scale

Level	Metric	Risk Level	Fall	Winter	Spring
Grade 5	Scaled Score	College Pathway	220 +	225 +	229 +
		Low Risk	213 - 219	216 - 224	218 - 228
		Some Risk	205 - 212	207 - 215	208 - 217
		High Risk	Less than 205	Less than 207	Less than 208
Grade 6	Scaled Score	College Pathway	224 +	229 +	231 +
		Low Risk	215 - 223	219 - 228	220 - 230
		Some Risk	206 - 214	207 - 218	208 - 219
		High Risk	Less than 206	Less than 207	Less than 207
Grade 7	Scaled Score	College Pathway	229 +	233 +	234 +
		Low Risk	219 - 228	222 - 232	223 - 233
		Some Risk	209 - 218	210 - 221	210 - 222
		High Risk	Less than 209	Less than 210	Less than 210
Grade 8	Scaled Score	College Pathway	234 +	237 +	235 +
		Low Risk	222 - 233	226 - 236	226 - 234
		Some Risk	212 - 221	213 - 2215	212 - 225
		High Risk	Less than 212	Less than 213	Less than 212

Table 3 shows the district-mandated math assessment average scores from the fall of the 2021-2022 school year to the winter of 2021-2022. Due to district requirements and policies, classroom environments for this assessment must maintain the traditional high-stakes testing environment. Student behavior and comments during this type of

assessment were noticeably more negative in teacher journal responses than during the manipulated classroom assessments. All students wondered and asked if this assessment would impact their grades, if their grown-ups would see their scores, and why the questions were so difficult (observation record, January 10, 2022). At least five students in each of the three classes within Student Group 1 had many questions about the vocabulary used in the assessment and had not learned much of the content being asked of them to complete. Majority of the students were visibly frustrated when teachers told them they were unable to help answer any questions due to the testing policy (observation record, January 10, 2022). The data collected shows a score increase of two for student group 1 and a score increase as well as a risk level decrease for student group 2.

Table 3

District Standardized Assessment Percentages

Student Group	Intervention Applied	Assessment	Average Score
1	None - District Policy prevents manipulation of testing environment	Fall Math	210 - Some Risk
		Winter Math	212 - Some Risk
2	None - District Policy prevents manipulation of testing environment	Fall Math	213 - Low-Risk
		Winter Math	214 - Some Risk

Hearing student responses after completing assessments for the district was supportive to the study but teachers needed more data points that shared these student feelings. Table 4 shows the responses of the student self-reflection form that was completed after two of the classroom chapter assessments. Both assessments show over

half of the students see themselves as successful in math after completing the chapter assessments. I suspect that those that did not see themselves as successful in math after assessments prefer traditional assessments, had frequent absences (due to COVID), or could have been struggling with anxiety outside of just in the classroom. Both assessments also show over half of the students responding on a scale of 1-5, 1 being not at all anxious and 5 being completely anxious, with 1 or 2 meaning a non-existent or minimal amount of anxiety. Using this data, small group teachers continued to teach in small groups for the remainder of the chapter assessments for the year as students expressed that that format was their preference. In the first assessment, at least five students in each of my three classes were verbally more positive and excited at the alternative assessment use so the combined results of 62% of students barely anxious and not anxious at all (rating one and two) were not surprising. The response of 66% of students feeling like successful mathematics students after the first assessment of the year was received by teachers as a moment of confirmation to continue with the altered testing environments. The percentages decreasing within the Chapter 2 Division assessment was expected among teachers. Division has historically been a more difficult topic for students. However, it was surprising that student self-reflection response percentages were decreasing and the Approach 1 assessment average percentage remained the same from Chapter 1 to Chapter 2.

Table 4

Student Self-Reflection Responses

Assessment	Survey Question	Responses Available	Student Responded
District Mandated Curriculum Chapter 1: Place Value, Properties, Multiplication, Order of Operations	I see myself as a successful math student.	True, False, Other	66% responded true 10% responded false 24% responded variations of being unsure
	On a scale of 1 to 5 with 1 being "not at all" and 5 being "completely anxious", how anxious did you feel before today's check-in?	Scale 1-5	32% selected 1 30% selected 2 28% selected 3 6% selected 4 4% selected 5
District Mandated Curriculum Chapter 2: Division	I see myself as a successful math student.	True, False, Other	53.7% responded true 11.9% responded false 34.4% responded variations of being unsure
	On a scale of 1 to 5 with 1 being "not at all" and 5 being "completely anxious" how anxious did you feel before today's check-in?	Scale 1-5	26.9% selected 1 26.9% selected 2 29.9% selected 3 10.4% selected 4 6% selected 5

Teacher journals (Appendix A) were recorded once a week and on each assessment day. This provided a minimum of five entries per month of the data collection time (October 2021-December 2021). Teachers record a class summary, what interventions were used, what was observed, heard, and wondered through the classes. This data collection was helpful as teachers were able to reflect often on the assessment process for both approaches as they occurred. This information became useful as the research ended and teachers made the decision to continue with Approach One and Two

for the last three curriculum assessments after the research window closed. Teachers from Approach Two reported that the movement created positive student responses and positive teacher observations when compared to historical mathematics assessment outcomes with the same assessments and school. Teachers from both approaches reported a significant increase in student achievement, students' self-confidence, students' ability to provide information on what they know without fear of being wrong, and specifically supported those that had other hurdles such as mental health concerns, English Language Learners, and the special education students. Teachers heard more questions being asked by students to increase understanding of what was being asked of them, questions being read aloud by students as they worked, and Spanish conversations between teacher and student to explain directions in students' native language. Teachers also heard positive comments like, "oh that's it?", "that wasn't so bad", and "there's no test? Yay!" (Teacher Journal, October 28, 2022). The positive reactions and relief from students continued overall assessment days.

Overall, the quantitative data collected through chapter assessments and district-mandated assessments provided a glimpse into the mathematical performance of the 2021-2022 5th grade mathematics scores. The district standardized assessment results are historically the same as in previous years. With the classroom environment unaltered and considering students' comments during assessment days, the average score was not surprising. The classroom district mandated curriculum assessment results given in manipulated classroom environments provided average scores that are higher than the average historically for the two classroom 5th-grade mathematics teachers. The qualitative data gathered with the use of student self-reflection forms and teacher

observations recorded in a teacher journal provides a glimpse into student conversations and feelings regarding their anxiety around mathematical assessments. After reviewing the student self-reflection form responses and reflecting on teacher journals, the teachers administering the assessments felt confident in their decision to continue to assess their students through Approach One and Approach Two.

Action Plan

The purpose of this study was to determine whether or not changing the human and physical components of a mathematics classroom would increase student mathematics confidence and performance on their assessments while decreasing the anxiety that accompanies mathematics assessments. During the district-required assessments, these components cannot be manipulated due to policy. However, the teacher-adapted curriculum assessments are given and created by teachers to match state standards and classroom material. These assessments can be given with altered physical classroom environments (student movement, small group desk placement during assessments, and normal routines proceeding in the background of the classroom) as well as with altered human components such as increased teacher-student communication during the assessment.

Throughout the manipulation of classroom environments during assessments, the teachers faced limitations due to the COVID-19 pandemic. An original intervention called Near Peers was intended to be used in tandem with the manipulated classroom environment. The goal of this intervention was to provide students an opportunity to see people who look like them successfully using mathematics in their daily lives. Through the review of the literature, this intervention was found to be successful when increasing

student mathematics performance specifically focusing on gender (females) and students of color or non-English speaking households. COVID-19 limited our options for bringing volunteers into the classroom and created hesitation among potential volunteers. Another limitation was in Approach One, small group assessment when student self-reflection was not completed after the third assessment. This was due to extreme amounts of student absences from COVID and inconsistent timing of student assessment for the Chapter 3 Decimals assessment. Another intended intervention was movement during an assessment. This was accomplished through the use of Approach Two (Math Museum). However, the original idea was to incorporate movement using wobble chairs in Approach One (small groups). Financially this was not a realistic intervention at the time. Another intervention, Imbertson's (2017) Accountable Talk strategy, was not intentionally and directly used in these interventions due to lack of time, but some elements are already included in our classroom teaching strategies.

Based on this study, through data collected in student self-reflection forms, teacher journals, and assessment scores, several conclusions were drawn. One of the first conclusions was that students averaged higher scores on the teacher-created assessments in a manipulated environment than they did in the traditional high-stakes testing environment on the district standardized test. In addition to performing worse on standardized assessments than classroom assessments, students expressed more anxiety concerns about the standardized test than they did about their chapter assessments. Another conclusion was that students expressed fewer concerns leading up to the chapter assessments and asked more questions during chapter assessments than in previous years. A final conclusion drawn by teachers included in this research was that they were able to

observe an increase in student confidence in their ability to show their math knowledge when avoiding the word test and the traditional test environment which resulted in more math being completed and more correct outcomes after working independently. That along with communication skills and altering the learning environment impacted mathematic assessment scores greatly.

Based on the findings and conclusions of this study, there are four significant recommendations for mathematics teachers. The initial recommendation is to include movement and small group assessments with middle school mathematics students to support their mathematics confidence. While assessing in small groups, teachers of this study would also recommend student self-reflection to assist teachers in modifying and adapting the classroom testing environment to match the needs of students as they grow during the academic year. Another recommendation going forward is for the teachers of this study to incorporate Imbertson's (2017) Accountable Talk. The final recommendation for the teachers included in the study and others, would be to incorporate more than one intervention such as movement in small group testing and incorporating Near Peers when COVID policies allow for this interaction.

Based on the specific research results I received through this research, I would like to continue to modify and adapt my classroom assessment environment (when able) with the use of small group testing. I will also go deeper into this question by incorporating movement within small group assessments to combine both approaches used in this research in the 2021-2022 academic year. I believe it is important for other teachers to also explore the use of small group assessments and movement during assessment to better support their students' performance anxieties. I would continue in a

similar research method as this research but incorporate wobble stools as the movement during lessons and assessment for students with increased testing anxiety and low mathematics confidence. I think the use of a student self-reflection form is important to continue to hear and gather student voices in their assessment methods. I would reword the final question of the form to make the language more friendly to younger students (see Appendix B). The other teachers included in the research agreed that this model of assessment supports the students who struggled the most with uncontrollable hurdles such as suffering from mental illness or a low-self-image as a successful mathematician.

The use of movement and small group style during assessments could improve teaching and learning if educators choose to increase opportunities for teacher-student connections. Small group assessment provides this support by increasing the proximity and volume level for easier access to ask the teacher questions during an assessment. Movement increases students' engagement with an activity, therefore, increasing their mental state of flow. Doing so in classrooms will aid in meeting the basic needs of students prior to accurately assessing their academic abilities.

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Appendix A
Teacher Journal

Date:	Assessment:	Class Period:
Intervention(s) Used: <ul style="list-style-type: none"> • Flexible seating 	<ul style="list-style-type: none"> • Small group testing • Performance-Based Assessments 	<ul style="list-style-type: none"> • Near-peer role model • Other:
Class Summary:		
What I Saw:	What I Heard:	What I Wondered:

Appendix B
Student Self- Reflection Form (Google Forms)

Please answer honestly about today's math check-in. Think about completing a check-in versus taking a test to help you answer the last few questions.

1. What check-in did you complete today? *Mark only one oval.*
Chapter 1 Multiplication, PEMDAS, Properties, Place Value Chapter 2 Division
Chapter 3 Decimals
Chapter 6 Fractions
2. I see myself as a successful math student. *Mark only one oval.* True, False, Other:
3. Finish the sentence: Math check-ins are_____
4. How did working on the check-in make you feel?
5. On a scale of 1 to 5 with 1 being "not at all" and 5 being "completely anxious" how anxious did you feel before today's check-in? **Mark only one oval.* 12345
6. If all future assessments were structured like today's was, how anxious will you feel about future assessments? (1 not at all - 5 completely anxious) **Mark only one oval.* 12345
7. Today we used a different model of assessing your learning. How would you describe that change? *