A QUANTITATIVE STUDY INTO THE EFFECTS OF THE PHYSICAL CLASSROOM ENVIRONMENT ON SECONDARY MATHEMATICS STUDENTS' ACADEMIC ACHIEVEMENT AND PERCEPTIONS OF TEACHER LEADERSHIP

BY

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DEDICATION

Ultimately, God provided me with the opportunity to earn this degree. This dissertation and this degree belong to Him. All I can say is thank you, Jesus. May I use this degree for Your purposes and to walk the path that You have for me.

This dissertation is dedicated to my incredible support system that includes my husband, Marcos, my sweet baby, Mikey, my mom, Annie, mother-in-law, Sandra, sister-in-law, Michelle, and aunt-in-law, Rosa (Pita). I would not have been able to fulfill the doctorate requirements and earn this degree without all of their love and support. I also want to dedicate this dissertation to my father who passed away in 2015 and whose greatest wish was for me to become a doctor someday. I may not be the medical doctor that he or I initially envisioned, but I still achieved the highest level of academic prestige in the field of education and worked hard to earn this degree. I am confident that he would be very proud of me.

My greatest hope is that this degree represents a strong foundation for the educational attainment that Marcos and I hope for Mikey and any other child(ren) that we may gain in the future. I pray it serves as an encouragement to set challenging goals, and I pray it instills confidence to reach those goals because I (Mom) did it. May this dissertation and doctorate degree be part of an inspiring legacy that I can leave with my family, all the colleagues, and all the students that I have impacted well after I am gone.

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ABSTRACT

Many students in Title I, low-income public high schools in the Pacific southwest do not appear to have the same levels of academic mastery as their more affluent counterparts. This dissertation examines whether a classroom environment has an effect on students' perceptions of their teacher and academic achievement, and consists of a causal comparative, quantitative research study. The treatment group took place in an optimally designed classroom, while the control group took place in a non-designed classroom. The sample was chosen based on readily accessible participants and purposive in that all subjects were in the same math course with the same teacher. Each class contained around 30 students, mostly sophomores, and half English learners. An independent two-samples t-test and Mann-Whitney U test were used to compare assessment results measuring academic achievement, while a Mann-Whitney U test was used to compare Multifactor Leadership Questionnaire results measuring perceptions of the teacher's leadership. The findings of this study did not yield any statistically significant differences between the academic performance and the perceptions of the teacher's leadership between the control and treatment groups, suggesting that the classroom environment had no effect on students' perceptions of their teacher or their academic performance. Differences between student sub-groups, grouped by English proficiency status, provide a basis for analysis and discussion. The primary audience includes administrators, teachers, and district personnel who have the ability to allocate resources to address this leadership issue of providing an enriching and relevant classroom for secondary students.

Keywords: classroom, achievement, perceptions, leader, environment, design, decorated, organized, English learner, English-only, engagement

CHAPTER 1: INTRODUCTION TO THE STUDY

The educational system in the United States is inequitable to students of color, English learners, students with special needs, at-risk populations, and students with low socioeconomic status. Historically, education reform movements aim to elevate these students' outcomes through increased funding and new programs, measuring academic success by standardized testing and graduation rates. While the ultimate goal of educational reform is to help every student succeed and graduate high school, years of educational reform show little to no improvement in at-risk students' outcomes (Kotok, 2017). Improving graduation rates is a key issue in education because of its relationship to successful life outcomes. People who do not complete high school are more likely to live in poverty and create a generational legacy of underperformance in school and limited access to important resources for their children (Cavendish et al., 2017). The purpose of educational reform in secondary schools is to improve graduation rates because lowering the dropout rate may positively affect the country's future and the life trajectory of each high school graduate.

Study Background/Foundation

Increasing student engagement may be a key to improving high school graduation rates. In their article on student engagement in high-stakes accountability systems, Cavendish et al. (2017) mentioned student disengagement relates to decreased likelihood of graduation and limited educational opportunities, stunting access to successful life outcomes. Despite the waves of educational reform targeting underachieving schools, minority students continue to struggle within the American education system (Kotok, 2017; Schmid, 2001). This might be due to the fact that typical classrooms attend to the

needs and reflect the practices of a dominant, White culture, despite many researchers arguing that minority students perceive the world differently and benefit from strategies and practices fitted to their learning style and encompass elements of their culture (Chouari, 2016; Schwartz, 2019; Tomlinson & Strickland, 2005; Van de Walle et al., 2013). One typically overlooked way to engage underprivileged students may be through the classroom environment.

As a country with an increasingly multicultural population, American educators may need to assess whether they provide welcoming, inclusive, and engaging classroom environments for students of color, who also disproportionately make up a school's English learners, students with disabilities, homeless and foster youth, and at-risk student populations. The environment can have a powerful impact on a student's sense of belonging, academic achievement, and perceptions of their teacher leader. Particularly for English learners, the physical classroom space is known to correlate to levels of engagement and classroom management (Bullard, 2009; Sahin et al., 2011). Maximizing the design of these spaces may result in a welcoming environment and a model of educational equity.

This study focuses on students in a Title I, low-income public school and the English learners (ELs) within this student population. A Title I school is defined as a school where at least 40% of students qualify for the free and reduced lunch program. Similar to many schools' increasingly diverse demographics around the country, the high school in this study is over 86% Latino/a population and 6% Filipino population, many of whom are English learners. The English learner population makes up half or more of the student population in every general education class at this school. The population in this

study includes all students in two general education high school math classes, including English learners and English-only students, and the purpose of the study is to determine whether the physical classroom environment impacts students' academic achievement and students' perceptions of their teacher. The general education math classes in this study are called Structured English Immersion (SEI) classes at the school because of the high volume of English learners. The mathematical assessment used in this study includes special attention to academic vocabulary and language acquisition. Language acquisition is important to assess for all students, but especially for English learners in this study, since classroom walls have already been shown to improve English learners' engagement and language acquisition at the elementary level (Alshaiji & Alsaleem, 2014; Hernandez et al., 2014; Hooper & Harmon, 2015; Jackson, 2018; Kieff, 2003). Themes of language acquisition and equity in educational achievement for students at low-income schools and English learners are prevalent throughout this dissertation because of the extent of this student population at the researcher's high school.

Current State of the Field in which the Problem Exists

The state of the United States education system first came into question in *A Nation At Risk?* by the United States Commission on Excellence in Education (1983). While this reform movement called for greater attention to outcome-based education systems, mainly through test scores, the reform movement that follows, No Child Left Behind (NCLB) in 2001, places even greater emphasis on standardized math and reading scores as proof of a good education. The Every Student Succeeds Act (ESSA) in 2015 and the Common Core State Standards are more recent waves of movements that continue to prioritize testing and measure the quality of learning and education through

students' test performance. This increasing and perpetual demand for score improvement has become characteristic of all school climates but has not made much of a difference in academic achievement output.

The education system may not need another wave of reform that fails to benefit the most needy student groups. It may be a greater use of the United States' resources to research best teaching practices that elicit the highest levels of student engagement, and then use these findings to launch strategic professional development. Teachers who know how to best engage students may improve academic outcomes, graduation rates, and participation in school (Chi & Chi, 2014; Freeman et al., 2015; Sousa & Dierendonck, 2017) more efficiently than the next federally-based reform movement. Developing teachers who know how to engage students takes the form of building skills in teachers and increasing their professional capacity through mentoring, coaching, and properly designing academic environments (Argenti, 2017; Fulmer & Brock, 2014; Ismail et al., 2018).

The issue of widespread school reform remains an educational issue that has not solved any long term problems in education that include advancing minority student groups and improving graduation rates. Sarason (1990) claimed that all reorganizing trends will have marginal to no effect until educational stakeholders go beyond the surface and familiarize themselves with unseen values, attitudes about power, knowledge, and privilege that result in shifts in how they think, interact, and entertain new ideas. If superficial change is not effective in improving at-risk students' outcomes, then internal, school change, perhaps coaching teachers on how to set up the walls within their classrooms to help them teach and appeal to students, may be instrumental in engaging

students in school, improving their access to the curriculum, and elevating their academic achievement.

Historical Background

One aspect of this study is to measure the impact that a classroom environment has through studying high school students' perceptions of the teacher and academic performance. The study will be grounded in the broken windows theory (Wilson & Kelling, 1982), which emphasizes that people are more likely to break windows, write graffiti, or deface an environment if it has already been defaced. The broken windows theory asserts the converse phenomena as well: if an environment is beautiful and well maintained, people are less likely to abuse or vandalize it. Students who learn in an organized and beautiful classroom environment that is tailored to their learning needs may be more respectful of the space, the teacher, and the learning process.

Recent studies reinforce the power of perception and how behavior is usually driven by expectations and social cues from the environment. Cues in people's environment are strong determining factors in what actions people take (Carter & Fuller, 2015; Cialdini, 2006). Students may be more likely to litter the physical classroom with trash and graffiti, and/or "litter" their brains with non-academic material during class if their environment appears to be littered or defaced. Students' attitudes toward the environment make a difference, and what they perceive as the norm is the key. A teacher who allows and models a messy and unorganized classroom environment may experience student behaviors that mirror disorganization, uncleanliness, and disengagement.

Deficiencies in the Evidence

The teacher is in a unique position to influence the success of students and the success of a school because of his/her close proximity to students in sharing a classroom environment and modeling a leadership role in students' educational journey. In a study on enhancing secondary school instruction and academic achievement, Allen et al. (2015) demonstrated an association between teacher-student relationships and student success. In a different study that reaffirms teachers' importance, Hattie (2009) synthesized over 500,000 studies on the effects of influences on student achievement, finding that teacher factors accounted for 30% of the variance. A teacher's role may be the most determining factor in the failure or success of a school in a country where great disparity exists between the achievement of White and minority students (Allen et al., 2015; Grosse, 2019; Jimerson & Haddock, 2015). The researcher has found no known study that examines the possible effects that a classroom environment can have on high school math students' academic achievement and perceptions of their teachers. If a teacher sets his or her classroom environment up for success by erecting certain types of bulletin boards and visually organizing policies, procedures, and supplies, this may be a first step in eliciting the engagement necessary to help all students succeed. It is possible that optimal physical learning environments are the springboard for optimal student engagement and outcomes.

There may be many meaningful changes and improvements within the education system that can be initiated by teachers in their individual classroom contexts rather than by a wide-sweeping national reform movement and mandated standardized testing. The classroom environment is where the hard work of teacher-student connection, relationship, trust, and learning begins (Allen et al., 2015). In a qualitative study on seven

males and their teacher's pursuit to disrupt the school-to-prison pipeline, Gass and Laughter (2015) noted hopeful findings that suggest teachers might play a role in disrupting the school-to-prison pipeline but strong student-teacher relationships are necessary. They also found that the majority of students agreed that teachers were a major source of encouragement, affecting students' beliefs that they were capable of completing high school and becoming successful. Elements besides testing that may point to educational success may be students' perceptions of belonging, engagement, and welcoming in a school environment where a student feels comfortable connecting with his/her teacher. A teacher can use the walls of his/her classroom environment to present a positive classroom culture, teaching expertise, organized classroom procedures, consistent rules and expectations, and a unified vision/theme to house safe student-teacher connections that are vital to student and school success (Falkner & Payne, 2020; Gass & Laughter, 2015; Grosse, 2019; Lekwa et al., 2019).

While much research supports the idea of individual coaching to improve leader and follower performance in the business sector, little research about individualized coaching and support for how to help secondary teachers maximize the design and use of their classroom space to supplement their teaching exists. In a study on the effectiveness of individual coaching, group training, and self-study, Losch et al. (2016) found that the satisfaction of participants was higher, scores on multiple choice tests were higher, goal attainment progress was higher, and procrastination was reduced for participants who received individual coaching. This may also be true for teachers who are individually coached to know what elements make up a strategically designed classroom environment that supports learning, welcomes students, and demonstrates the teacher's preparedness

and knowledge of the subject matter. Individualized coaching and professional development to help high school teachers maximize the design of their classrooms is particularly relevant to school administrators and budgeting personnel if this study determines that students who learn in an organized and well-designed classroom have higher academic achievement and more positive perceptions of their teacher than students who learn in a disorganized and non-designed classroom space.

There are older studies on classroom environments that illuminate how changes in lighting and paint can positively influence student achievement, reduce anxiety, and improve behavior (Kephart & Floyd, 1954), but little current research as to the importance of the physical environment for student learning. The literature that exists pertains exclusively to elementary-level classrooms. The city-run early childhood program of Reggio Emilia, Italy, has become recognized and acclaimed as one of the best systems of education in the world. The Reggio Emilia approach stresses the environment as the third teacher (Gandini,1998). The layout of space that includes desks, tables, materials available, and what is displayed on the walls, conveys messages about the relationship between teaching and learning, teachers' perceptions and beliefs about the child, and the expectations for behavior and learning within that setting (Gandini 1998; Rinaldi 1998; Simco 1996). The Reggio Emilia approach and Gandini (1998) illuminate how and why many elementary classrooms present much attention to detail in designing the wall space to act as a third teacher, however, many secondary classroom environments lack comparable attention to design, academic enrichment on the walls, theme, detail, organization, or decoration.

There are no current studies in educational literature that examine how the display of a classroom with academically enriching wall decor, bulletin boards, and organized supplies and materials can impact secondary math students' achievement and perceptions about their teacher. The research in this dissertation study is the first of its kind in diverting the focus from elementary-level classrooms to a secondary mathematics classroom to determine whether the physical environment can impact students' learning and perceptions of teacher leadership.

Problem Statement

Although the physical classroom environment has been shown to correlate to improved language acquisition (Kieff, 2003), engagement (Bullard, 2009; Sahin et al., 2011), and academic achievement (Asiyai, 2014; Durmus, 2016; Sahin & Top, 2015), many secondary classroom environments lack the attention to design, academic enrichment on the walls, theme, detail, organization, or decoration that many elementary classrooms present. In the opinions of most of the researcher's colleagues who are all secondary teachers, students' age, mobility in moving from class to class, and seeming disinterest in classroom decoration are valid reasons to neglect the classroom environment.

Current literature has not examined the possible impact that classroom design has on secondary student engagement. Due to this gap in the literature, many secondary school districts lack expectations about the classroom environment, and there is little to no support or materials for teachers to optimally design a space around students' learning needs.

While numbers of English learners in US schools are growing, their academic scores are not advancing at the same pace. English learners make up a significant portion of the student population at the researcher's school and in the researcher's classroom, but they present significantly diminished achievement compared to English-only students. In an article on Latino English language learners and bridging achievement gaps, Good et al. (2010) found that communication gaps and lack of adequate teacher preparation in multiculturalism, how to effectively teach language acquisition, and ELL instructional strategies were among many reasons Latino English language learners consistently underperformed. Marlow (2008) noted the gaps between English-only students and English learners, highlighting a 46% gap in test scores on the 2005 National Assessment of Educational Progress. English learners are not advancing at the same levels as their English-only peers. Despite the abundance of educational literature addressing and examining best practices for English learners and English as a Second Language (ESL) teacher preparation requirements for aspiring California teachers, growing educational inequity persists between English learners and English-only students.

Consistent with EL achievement gaps nationwide, assessment data shows the underperformance of the researcher's EL population at Mighty High School (pseudonym). The public school is in the Pacific Southwest, within four miles of the Mexican border, and consists of three categories of English learners: Long Term English Learners (LTELs), Short Term English Learners (STELs), and Reclassified English Proficient (RFEPs). An LTEL is a student who has been in the United States for more than six years, but has not progressed toward English proficiency. These three classifications of English learners make up 64% of the student population. Mighty High

School's results on the California Assessment of Student Performance and Progress (CAASPP) test in 2018-2019 reveal that only 11% of English learners reached "proficient" or "advanced" levels compared to 42% of English-only students reaching "proficient" or "advanced" levels. These statistics highlight the underperformance of the English-learner student population at the school.

One of Mighty High School's objectives is to provide a high quality and equitable education to all students. Based on the CAASPP data, it appears a high quality, equitable education is not provided for ELs. The underperformance of this student population has been a significant pattern for many years, and a trend that Mighty High School has not been able to improve throughout its history.

Audience

The most immediate beneficiaries of this study are: (1) low income, public high school students, (2) secondary administrators, (3) teachers, (4) grant writers and budget personnel, and (5) educator preparation programs.

The findings of this study will contribute to the way secondary teachers and educational leaders assign resources, time, and expectations to the physical classroom environment. An optimal classroom environment may prove to positively impact student engagement in school, improving graduation rates and life outcomes. If these findings develop, leaders in education may allocate greater attention and resources to how to individually coach and support teachers in creating optimally designed and organized classrooms that mirror the classroom the researcher uses in the study.

As a result of this study, educational leaders may better understand the importance of secondary physical classroom environments, deserving of just as much

time, attention, detail, and organization as elementary-level classrooms in order to best support English learners and other at-risk student populations. With proper vision and design, classroom spaces can transform into learning environments that better support English reading, writing, spelling, and speaking (Alshaiji & Alsaleem, 2014; Hernandez et al., 2014; Hooper & Harmon, 2015; Jackson, 2018; Kieff, 2003; Rosha & Lace, 2015). This study may contribute to future research on how to best provide equitable learning environments for diverse learners through twelfth grade, using classroom walls to organize academic content, scaffold, provide visual enrichments, and display the expertise and readiness of the teacher.

Specific Leadership Problem

Given the current state of English learners' underachievement in most American urban public schools, and the underachievement of students in low-income high schools, an initiative aimed at increasing the engagement of this population may create a more equitable education for all students. Students who disengage from school are more likely to drop out and experience poor life outcomes (Cavendish et al., 2017). A school's ability to find ways to increase student engagement may increase graduation rates and improve student outcomes. A classroom's physical environment has the power to elicit engagement, language acquisition, and achievement from students, as well as moderate behavior (Asiyai, 2014; Bullard, 2009; Durmus, 2016; Sahin et al., 2011; Sahin & Top, 2015; Zbeik & Larson, 2015). A new initiative that may effectively address learners' needs and increase their engagement is the funding of classroom design coaches to help teachers better address a wide range of students' learning needs, centralize students' voices, cultures, and experiences, and organize the flow of information within the

physical classroom environment. Educational leaders must decide whether to continue with the status quo or fund a change initiative that could positively affect the trajectory of underprivileged and underperforming student populations.

Purpose of the Study

The purpose of this quantitative study is to identify the impact that a classroom's organization and design has on students' perceptions of their teacher's leadership and to identify the impact that a classroom's organization and design has on students' mathematical academic performances. This quantitative study involves one teacher and two groups of students from a low-income, public high school: (1) the treatment group consists of a math class conducted in an optimally organized and designed environment and (2) the control group is a math class conducted in an unorganized and non-designed environment. An operational definition of a "designed" classroom for this study includes all of the following: the presence of a vocabulary word wall and academically helpful posters, posted incentive system, posted rules, posted positive and negative consequences, visible classroom theme, and accessible station with student materials, labeled materials, and a clean teacher desk. Non-designed is used to describe a classroom environment with one or multiple items missing from the list in the definition of "designed" above. The non-designed classroom in this study does not present a vocabulary word wall, no academically helpful posters, no posted incentive system, no posted rules or consequences, no class theme, and no labeled materials. An operational definition of "organized" for the purpose of this study is 0-10 items out of place at any time within the classroom. Unorganized is defined as 11 or more items out of place. The findings from this study will determine whether specific features of a classroom

environment, namely the academic enrichment in organized bulletin boards, vocabulary word walls, posted incentive systems and rules, organized student materials, and teacher materials, have an impact on students' perceptions of the teacher as a leader and academic performances.

Methodology and Research Design Overview

This quantitative study involves one public high school math teacher and two sets of students from different class periods. The classes are as similar as possible for comparison in terms of how many English learners are in each class, how many students with special needs are in each class, and what time of day the classes take place. The teacher teaches one class in a well-organized and well-designed classroom, and the second class in a non-organized and non-designed classroom for the first three weeks of the school year, which is just enough time to cover a review unit on solving equations. The study uses data supplied from the Multifactor Leadership Questionnaire (MLQ), measuring students' perceptions of the teacher as a leader, and a mathematical assessment, measuring academic achievement.

A quantitative approach with a causal comparative design is best suited for this research study because of the researcher's use of a researcher-created mathematical assessment and valid questionnaire to assess the impact of a physical classroom's effectiveness without random selection and compare differences between groups. A group comparison is used to determine the impact of a secondary teacher's physical classroom environment on students' perceptions of the teacher and students' mathematical performances. The data gathered from two groups is compared in terms of between-group mean differences on perception ratings and common formative

assessment scores. The goal is that the physical context is the only variable between the two groups in comparing their data to see if the physical context impacts academic achievement and perception differences between groups. The study includes an independent two-samples t-test and a quantitative, causal comparative research design, with both descriptive and inferential statistics (Rockinson-Szapkiw, 2013). The study also includes a Mann-Whitney U test because perceptions about the teacher as a leader are measured as a frequency rating only. The Mann-Whitney U test is required for a non-parametric statistic to test significance of difference in average rating between two separate groups.

Research Questions/Hypotheses

This study addresses the following research questions:

1. What is the difference in mathematical academic performance, as measured by scores on a common formative assessment, between public high school students who learned math in a well-organized and well-designed classroom and students who learned math in an unorganized and non-designed classroom?

    1a. What is the difference in mathematical academic performance, as measured by scores on a common formative assessment, between English-only students and English learners who learned math in a well-organized and well-designed classroom and students who learned math in an unorganized and non-designed classroom?

    1b. What is the difference in mathematical academic performance, as measured by scores on a common formative assessment, between

Short Term English Learners (STELs), Long Term English Learners (LTELs), and Reclassified English Proficient students (RFEPs) who learned math in a well-organized and well-designed classroom and students who learned math in an unorganized and non-designed classroom?

2. What is the difference in public high school students' perceptions of teacher leadership between a teacher in a well organized and designed classroom and a teacher in an unorganized and non-designed classroom?

Null hypothesis for Research Question #1: There will not be significantly higher assessment averages among the secondary mathematics students in an organized and well-designed classroom environment (as defined by 0-10 items out of place at any given time and meaningfully designed bulletin boards and wall space) than students in an unorganized and non-designed classroom environment as measured by a common formative assessment.

Alternative hypothesis for Research Question #1: There will be significantly higher assessment averages among the secondary mathematics students in an organized and well-designed classroom environment (as defined by 0-10 items out of place at any given time and meaningfully designed bulletin boards and wall space) than students in an unorganized and non-designed classroom environment as measured by a common formative assessment.

Null hypothesis for Research Question #1a: There will not be significantly higher assessment averages between English-only students and English learners in an organized and well-designed classroom environment (as defined by 0-10 items out of place at any

given time and meaningfully designed bulletin boards and wall space) than English-only students and English learners in an unorganized and non-designed classroom environment as measured by a common formative assessment.

Alternative hypothesis for Research Question #1a: There will be significantly higher assessment averages among English-only students and English learners in an organized and well-designed classroom environment (as defined by 0-10 items out of place at any given time and meaningfully designed bulletin boards and wall space) than English-only students and English learners in an unorganized and non-designed classroom environment as measured by a common formative assessment.

Null hypothesis for Research Question #1b: There will not be significantly higher assessment averages among Short Term English Learners (STELs), Long Term English Learners (LTELs), and Reclassified English Proficient students (RFEPs) in an organized and well-designed classroom environment (as defined by 0-10 items out of place at any given time and meaningfully designed bulletin boards and wall space) than Short Term English Learners (STELs), Long Term English Learners (LTELs), and Reclassified English Proficient students (RFEPs) in an unorganized and non-designed classroom environment as measured by a common formative assessment.

Alternative hypothesis for Research Question #1b: There will be significantly higher assessment averages among Short Term English Learners (STELs), Long Term English Learners (LTELs), and Reclassified English Proficient students (RFEPs) in an organized and well-designed classroom environment (as defined by 0-10 items out of place at any given time and meaningfully designed bulletin boards and wall space) than Short Term English Learners (STELs), Long Term English Learners (LTELs), and Reclassified

English Proficient students (RFEPs) in an unorganized and non-designed classroom environment as measured by a common formative assessment.

Null hypothesis for Research Question #2: Secondary mathematics students' perception ratings of a teacher's leadership will not be significantly higher in the presence of a teacher's organized and well-designed classroom than in the presence of a teacher's unorganized and non-designed classroom.

Alternative hypothesis for Research Question #2: Secondary mathematics students' perception ratings of a teacher's leadership will be significantly higher in the presence of a teacher's organized and well-designed classroom than in the presence of a teacher's unorganized and non-designed classroom.

Study Limitations

The study has its limitations due to the inability of the researcher to have two different groups of identical students in each class period. There was a slightly higher percentage of English learners in the control group compared to the treatment group. Both classes were conducted around the same time of day, but not at identical times. The control group in the non-decorated classroom took place every day from 12:45p.m.-1:45p.m., while the treatment group in the decorated classroom took place from 1:50p.m.-2:50p.m, creating unavoidable variability between classes. The classrooms used were also not identical in terms of the years they were built and the classroom furniture provided in each. The researcher was limited in using a classroom for the control group in which the class took place during a colleague's prep who allowed the researcher to access the classroom. There were no empty classrooms at the school, much less within the researcher's own building where the classrooms have similar furniture, same number of

windows and lighting, and were built in the same year. The study was also limited because the researcher was not able to conduct the study with random selection. These classes were pre-assigned to the teacher from the master schedule at the high school. There was no way for the researcher to randomly select a class within the school or school district. This study was also limited to mathematics, and may have different results in other subject areas and/or more affluent areas of the community. The results of this study might not be generalizable to other schools because of these limitations.

Study Delimitations

Boundaries were placed on the study to narrow the population and measure the impacts of a classroom's organization and design on urban, low income, public high school math students. The decision to narrow the study to only two math classes was made to narrow the range of teachers and course subjects. Boundaries were also placed on how many mathematical assessments were analyzed. This was an acute, rather than long-term study because of the potential ethical problems associated with teaching one group of students in a better environment than another for a prolonged amount of time. The common formative assessment was used in the study, but not entered into each student's grade. After the first assessment, all students resumed class in the organized and decorated classroom since the researcher hypothesized that this would be an optimal learning environment that leads to better outcomes for students. Due to these boundaries, the findings and results of this study may not be generalizable to other subjects, locations, or future time periods.

Definitions of Key Terms

To avoid ambiguity, the following terms are defined for the purposes of this study:

Classroom Environment – is used to describe a stable/consistent area that an educator teaches within. This study assumes the classroom environment is a room with walls that have the ability to display academic material and classroom policies and procedures. This study also assumes there is one teacher per classroom and that the teacher does not share the classroom or move from class to class throughout the day. The classroom environment refers to the entire square footage within the walls of a classroom, including the square footage of the walls from the floor to the ceiling and the room space in between that includes desks, furniture, and the presence of school supplies and/or learning materials.

Organized – is used to describe a classroom with 0-10 items out of place at any time within the classroom. Items may include classroom supplies like a stapler, three-hold puncher, textbooks, paper, or handouts for the day, or things like trash, food, dirt, vandalism, or any form of uncleanliness.

Unorganized – is used to describe a classroom with 11 or more items out of place, broken, unusable, vandalized, messy, cluttered, or dirty as stated in the "organized" definition.

Design of a classroom – is used to describe specific features of a classroom environment, namely the academic enrichment shown on bulletin boards, vocabulary word walls, posted incentive systems and rules, posted classroom theme, organized student materials, and teacher materials, that have an impact on students' perceptions and

academic performances. An operational definition of a “designed” classroom for this study includes all of the following: the presence of a vocabulary word wall and academically helpful posters, posted incentive system, posted rules, posted positive and negative consequences, visible classroom theme, and accessible station with student materials, labeled materials, and a clean teacher desk.

Non-designed - is used to describe a classroom environment with little to no academic enrichment shown on bulletin boards, no vocabulary word wall, no clearly posted incentive systems and/or rules, and no organized place for students to access materials. The walls and space within the classroom are either barren or filled with items that are irrelevant to enriching the academic environment. An operational definition of “non-designed” classroom for this study is a classroom environment with one or multiple items missing from the list in the definition of “designed” above. The non-designed classroom in this study does not present a vocabulary word wall, no academically helpful posters, no posted incentive system, no posted rules or consequences, no class theme, and no labeled materials.

Secondary School – refers to a high school with students in grades 9-12.

English Learners – are students whose primary language is one other than English and who are unable to communicate fluently or learn effectively in English.

Short Term English Learner (STEL) – refers to a student who entered the United States education system as an English learner who has been in the United States education system for less than six years who has not yet reached English proficiency.

Longer Term English Learner (LTEL) – is used to describe an English learner who has not achieved English language proficiency within six years of initial classification.

Reclassified Fluent English Proficient (RFEP) – is used to describe an English learner who has been reclassified as fluent in English based on a number of criteria, including the California English Language Development Test (CELDT), achievement in English Language Development (ELD) courses, and ELA testing performance.

At-Risk Students – encompasses disadvantaged student groups such as: students with special needs, homeless and foster youth, students at risk of abuse or neglect, and English learners.

Perceptions – is used to describe the interaction of the perceiver with his/her environment (Haber, 1968). Perception represents a continuum of sensation and memory all involved in information processing. Visual perception theory includes bottom-up processing, meaning the perception of an object begins with visual stimulus (Gibson, 1966). The eye sees an object and sends this information to the visual cortex of the break where the object is interpreted. Visual perception theory also includes top-down processing which deals with the mind's ability to interpret information and patterns in a given context (Gregory, 1970). A context, word, or sentence can be identified and given meaning.

Summary

The purpose of this quantitative, causal comparative study is to measure the impact that a classroom design initiative could have on secondary math students and English learners by comparing the means of two different class periods of students'

perception ratings of their teacher and their academic performance on a mathematics common formative assessment at a low-income public high school in the Pacific southwest.

Classroom design may increase engagement of the English-only students, and/or the English learner student populations, creating a more equitable education for all students at this public high school where these student populations consistently underachieve.

There are five chapters in this study as follows:

Chapter I outlines the background and purpose of the study. It details why this study is worthwhile, including the limitations and definitions of key terms that are used in the study.

Chapter II contains the literature review with the context, relevant findings, topics, and discussions related to the study. The main sections are (1) perceptions, (2) environment and language acquisition, and (3) environment and academic achievement.

Chapter III describes the methodology and design of the study in detail. It also includes justification for why a quantitative design is appropriate, and how it is a valid and reliable methodology to address the research questions.

Chapter IV presents the data collected from the mathematics assessment and the perceptions survey and a thorough analysis of the findings.

Chapter V integrates and summarizes the analysis of the study, including the importance, meaning, and significance behind the data and findings. It includes concluding statements as well as an evaluation of the entire study and offers recommendations for future studies into the topic.

CHAPTER 2: LITERATURE REVIEW

Many leaders in education must address the issue of increasing the engagement and achievement of students in low-income, Title I public schools, including attending to the needs of increasing numbers of English learners. In a study on student engagement in high-pressure school environments, Cavendish et al. (2017) highlighted that student disengagement connects to reduced likelihood of graduation and restricted educational opportunities, diminishing the possibility of successful life trajectories. The physical classroom environment is known to correlate to levels of engagement and classroom management (Bullard, 2009; Sahin et al., 2011). Enhancing the artifacts, organization, and presentation of these classroom spaces may provide a more equitable educational environment.

Any K-12 instructional leader can manipulate the classroom environment to maximize language acquisition (Alshaiji & Alsaleem, 2014; Kieff, 2003; Vintinner et al., 2015), academic achievement (Asiyai, 2014; Kephart & Floyd, 1954) and favorable perceptions (Astuti, 2013; Chi & Chi, 2014). Despite research-based appeals and prevalent expectations in elementary schools to create visually appealing, organized, and student-centered classroom environments, most secondary schools fail to establish this same expectation of environmental excellence (Afzal, 2013; Dorman et al., 2006; Moos and Trickett, 1986). Many secondary teachers do not erect word walls, hang graphic organizers or academic supports, organize supply stations for students' needs and autonomy, or post exemplary student work to centralize students in the classroom. Many secondary teachers view themselves as specialized to teach in a particular field, and do not necessarily have the design ability or willpower to strategically decorate a classroom.

Common perceptions among secondary teachers who work with the researcher is that there is no need to go to such lengths for the older students, decorations or supportive academic artifacts on the walls are only for younger kids, and that students are only in class temporarily before passing on to the next period.

Research contradicts these sentiments for secondary school students and highlights the discrepancy between teachers' perceptions of how to set up, or neglect, the secondary classroom environment, and students' actual learning needs that are not being met within the secondary classroom environment. In a study of 4,146 Australian secondary students' assessments of classroom environment to develop a typology of secondary school classrooms, Dorman et al. (2006) grouped 278 classes into five main clusters, with one cluster, cluster D, emerging as exemplary in every category. Cluster D had classrooms with the most positive environments, but these classes only made up 11% of the classes in the study, revealing there is much room for improvement for 89% of the remaining classroom environments (248 classes). If applying these statistics to public secondary school classrooms in the United States, this suggests that only about 1 in 10 classrooms are optimally designed to meet students' needs, leaving 9 in 10 in need of improved design.

Many secondary teachers are aware that they should improve their classroom environment, but neglect doing so due to a lack of proper prioritization due to an unawareness of its impact on student outcomes, lack of adequate resources (Durmus, 2016), and lack of expectation from administration. In a study on teachers' awareness of the classroom organization and learning achievement of the students in secondary public schools, Afzal (2013) found that, although many teachers are aware of the relationship

between classroom organization and learning achievement of the students at the secondary level, they were not implementing it properly as its importance was not being realized. Most teachers agree that classroom organization can affect learning achievement in secondary school students, but many do not recognize its full positive or negative impact on learning by failing to prioritize it.

The three sections in the literature review highlight the ways in which a physical environment can affect a person or group of people. Each section in the literature review give the reader insights into what the literature has determined impacts students and teachers in the classroom environment. The first section guides the reader through an understanding of how one's perceptions can influence behavior, achievement, and motivation (Chi & Chi, 2014; Sousa & Dierendonck, 2017; Zheng et al., 2020). The second section addresses how the physical classroom environment can be used to improve English language acquisition, specifically through the use of word walls (Alshaiji & Alsaleem, 2014; Kieff, 2003; Vintinner et al., 2015), and the third section addresses the connection between the physical classroom environment and academic achievement (Asiyai, 2014; Kephart & Floyd, 1954; Sahin et al., 2011). The purpose of this study is to determine whether the design and presentation of a physical classroom environment can influence student perceptions, which have shown to impact behavior, language acquisition, and academic achievement.

This literature review will answer the following questions:

1. How do followers' perceptions of their leaders impact their behavior (engagement) in a workspace?

2. How do followers' perceptions of their leaders impact their motivation in a workspace?

3. How do followers' perceptions of their leaders impact their achievement in a workspace?

4. In what ways has the physical classroom environment been used to improve English language acquisition in K-12 schools?

5. In what ways has the physical classroom environment been used to improve academic achievement in K-12 schools?

Literature Review

Perceptions are the foundation of this study. If perceptions of an environment influence behavior, motivation, and achievement of people, then perceptions of the physical classroom environment may impact student behavior, motivation, and achievement within a classroom, positively impacting their language acquisition and academic achievement as well. According to perception theorist and psychologist Richard Gregory (1970), humans receive information from the environment, which is then combined with previously stored information about the world that has been built up from experiences. This is a constructive process that relies on top-down processing and requires higher cognitive information either from past experiences or stored knowledge in order to make inferences about what is perceived. One's perception of an environment leads to inferences that have been shown to impact behavior, motivation, and achievement.

The broken windows theory illuminates the power that an environment can have on human behavior. Through their research, Wilson and Kelling (1982) coined the

phenomenon called broken windows theory, revealing that people were more likely to break windows, write graffiti, or deface an environment if it has already been defaced. The opposite also proved true. People were less likely to graffiti or litter in clean and well-maintained environments. Recent studies reinforce the power of perception and how behavior is usually driven by expectations and social cues from the environment. Cues in people's environment are strong determining factors in what actions people take (Carter & Fuller, 2015; Cialdini, 2006). Students may be more likely to litter the physical classroom with trash and graffiti, and/or "litter" their brains with non-academic material during math class if their environment appears to be littered or defaced.

Perceptions

Perceptions have the power to influence a person's beliefs, convictions, and feelings of security about a person or environment. In a study on interviews of youth perspectives on housing abandonment and its impact on individual and community well-being, Teixeira (2016) found that the participants believed abandoned properties signified no one cared about the neighborhood. Young people perceived pictures of a poorly kept property and made assumptions about the people who live in its environment as apathetic. A similar phenomenon may happen when students make observations of a classroom environment and use their observations to interpose judgment in their perceptions of the teacher who is usually the presumed owner, facilitator, and organizer of the classroom space (Patrick et al., 2007). It is reasonable to assume that a classroom space that appears messy, cluttered, dirty, disorganized, and in disarray may cause students to doubt or question the teacher's ability to organize or prepare in other areas of life, such as their ability to effectively manage or teach the class, and the converse is likely true for teachers

whose classroom environments are in pristine condition. The way a student perceives the classroom environment and/or the teacher can influence the student's behavior, academic achievement, and motivation in school.

Perception and Behavior

The physical classroom environment is proven to correlate to improved levels of student engagement and teachers' classroom management (Bullard, 2009; Sahin et al., 2011). Leaders who created an environment of "togetherness" and shared identity, benefitted from employees who experienced higher performance, better mental health, less burnout, greater job wellness, and more engagement at work (Steffens et al., 2014). Employees' sense of unity created an optimal work environment in the business sector and may be applicable to a classroom environment where employees can be exchanged for students, leaders traded with teachers, and work environments exchanged with classrooms. A similar article highlighted three main components to boosting engagement where Qijie (2017) suggested that leaders create a vision of excellence, design meaningful tasks, and build a community. United community and vision are themes in both articles that correlate to increased engagement. A teacher leader's ability to bring about this classroom unity and inclusivity, possibly through a classroom theme or unifying vision/mission statement, may experience more motivated and engaged students.

The way a student perceives a teacher as a leader can impact the way a student behaves. A teacher who structures a classroom around serving student needs may be perceived as a servant leader and experience the highest levels of student engagement. In their study on the effects of servant leadership and humility on follower engagement, Sousa and Dierendonck (2017) discovered that humble, servant leaders experienced the

highest levels of follower engagement. Servant leadership elevates followers' needs and may contribute to renewed job satisfaction, energy, and participation. A teacher who can use a classroom environment to meet students' needs may be more likely to be perceived as a servant leader. A classroom set up in a way that best serves students needs, such as organizing an area for student supplies, showcasing student work and culture, providing academic support on the walls, and posting an incentive system, may help establish a teacher as a humble, servant leader and elicit more positive behaviors from students.

Perception and Achievement

Perceptions of a classroom environment can impact a student's achievement in a class. In two studies examining the relationship between undergraduates' perceptions of their classroom environment, their adoption of achievement goals for the course, and their graded performance and intrinsic motivation, Church et al. (2001) found that the perceived classroom environment influenced achievement goal adoption, and achievement goal adoption, in turn, directly influenced graded performance and intrinsic motivation. Student perceptions of an environment impact their intrinsic motivation and the level of effort they deem necessary in a course, even impacting their goal adoption. Beautifying and maximizing the positive impact of a student's classroom environment may greatly impact students' academic achievement and intrinsic motivation to reach more rigorous goals.

Employees' perception of a leader, or students' perception of the teacher, may affect students' performance and efficiency. In an article on the motivational mechanisms between transformational leadership and employee functioning, Fernet et al. (2015) suggested that a leader's ability to create a motivational work environment that fostered

optimal job functioning depended on the leader's ability to act encouragingly and proactively on perceived job characteristics like honesty, approachability, expertise, and trustworthiness. A pristine physical classroom environment may enhance these positive perceived leader characteristics, especially in a students' perceptions of a teacher's expertise, and elicit optimal job functioning. Although not the only factor in shaping students' perceptions of a teacher, the classroom environment's ability to improve and shape positive impressions of a teacher should be taken seriously because of the academic benefits associated with these favorable dispositions.

Perception and Motivation

Students' perceptions of a classroom environment can positively or negatively affect their motivation to learn (Asiyai, 2014; Shih, 2015). Shih (2015) examined the relationships among Taiwanese adolescents' perceived classroom environment, academic coping, and burnout. He linked higher levels of classroom structure and peer support to engagement, support-seeking coping behaviors, and lower levels of academic burnout. This reveals the interconnectedness between classroom structure, or perceived classroom structure, peer support, behavior management, and academic burnout. Shih's (2015) study is parallel to Asiyai's (2014) study where he found that secondary school students' perceptions of the condition of the classroom physical learning environment had great impact on their learning and motivation, including the motivation to actively participate in academic activities, influencing their personal behavior and their school attendance. A classroom environment with attention to detail in its physical structure, organizational structure, and academic structure on the walls may enhance students' perceptions of higher levels of structure and diminish feelings of burnout in the classroom.

Similar to the idea of reducing burnout, the way teachers manage the classroom and choose learning resources takes part in motivating students. In a multi-case study on teachers' and learners' perceptions of motivational teaching strategies in Indonesia, Astuti (2013) found two groups of motivational components: (1) teachers' rapport with students, including the encouragement given to students and the building of trust and respect with the students, and (2) teachers' planning decisions such as the selection of classroom activities, the way feedback is given, the management of the classroom, and the choice of learning resources. The management of the classroom and the choice of learning resources directly connect to the way the teacher manages the physical classroom environment. The learning environment not only stores the learning resources, it also has the capability to display the learning resources and influence the way the teacher manages the classroom. The way a teacher sets up the learning environment can be considered a motivational teaching strategy.

Students who perceive their teacher as likable, having positive integrity, and having a willingness to serve are more likely to be satisfied and motivated. In a study on perceptions of leaders and follower's satisfaction, Drescher (2017) found that employee perceptions of a leader's likeability and performance correlates to employee job satisfaction. Similarly, Chi and Chi (2014) and Zheng et al. (2020) found that a leader's perceived positive integrity, willingness to serve, uniqueness, and sense of belongingness are connected with employee enthusiasm, physical and mental health, job satisfaction, energy, and perceptions of leader authenticity. When followers believed in a leader's genuine attention to their needs and care for their success, they were much more energized and engaged in their work because they felt supported and resourceful through

the leader's attention. Teachers who set up the classroom environment in a way that visually and functionally attends to students' academic, supply, and vocabulary needs through word walls, bulletin boards with graphic organizers, students supply stations, organized incentive systems, and clearly posted and implemented rules and expectations are more likely to empower their students, boost their motivation and attitude, and receive favorable perceptions.

Students' perceptions of a teacher can impact students' motivation in middle school science. In a mixed-methods study on the relationship between student perceptions of teacher-student interactions and motivation in middle school science, Smart (2014) found that students' perceptions of teacher behaviors were positively correlated with the efficacy for learning science. The way a student perceives teacher behaviors impacts their engagement and efficacy for learning in that teacher's class. These perceptions of a teacher and/or environment can greatly impact students' behavior, goal setting, motivation, and engagement in a classroom.

While students' perceptions of their teacher as a leader and their learning environment can greatly influence their behavior, achievement, and motivation, students' perceptions and the display of the physical environment may also influence their language acquisition and academic achievement. The actual environment can be designed in a way as to present strategic teaching artifacts that support students' language skills and academic achievement. A well-designed classroom environment may serve to both enhance student perceptions of an environment and reinforce student achievement through the visual support of academic materials.

Environment and Language Acquisition

The way artifacts are presented in a physical classroom environment can affect students' language acquisition (Alshaiji & Alsaleem, 2014; Kieff, 2003). Programs that prepare teachers to teach English learners encourage the use of vocabulary walls, pocket charts, graphic organizers, sentence starters, and visual enrichments as examples of helpful artifacts to use in enhancing students' language acquisition (Hernandez et al., 2014; Vintinner et al., 2015). The walls within the classroom environment have the ability to display and visually organize such artifacts and positively impact student's language acquisition.

Word Walls

Word walls are one example of how a physical classroom environment can be used to elicit student engagement and improve language acquisition in K-12 schools. Alshaiji and Alsaleem's (2014) study investigated the impact of word walls on improving the English reading fluency of kindergarten children from Saudi. Word walls significantly improved the English reading fluency of the children in the experimental group. Classroom word wall design can positively impact language acquisition. In a similar study on word walls' effectiveness, Kieff (2003) found that word walls supported the development of reading, writing and spelling skills in addition to interactive vocabulary activities. Walls within the classroom space can be designed with words in such a way as to enhance language acquisition.

Word walls may improve language acquisition at all K-12 levels. In an article on whether word walls are effective with older, secondary school learners, Vintinner et al. (2015) showed whether interactive word walls are effective in high school classrooms.

The authors used qualitative interview data from five English teachers and revealed that interactive word walls are effective in a high school environment, connecting interactive and frequently used word walls to increased language comprehension for English learners. Teachers who utilize the words and resources presented on their word walls experienced higher levels of language acquisition. Word walls demonstrate how teachers can use the design of a classroom wall to engage students and meet language-learning needs.

In an article on improving vocabulary instruction for Latino English learners, Hernandez et al. (2014) advocated for words walls and anchor charts as excellent vehicles for teaching Latino ELLs important and essential meaning making and spelling strategies. Students in the primary grades can reinforce their vocabulary learning at various times during the school day as a result of the presence of word walls and anchor charts. Similar benefits of language acquisition are echoed in Hooper and Harmon's (2015) article on word walls in middle school science classrooms, revealing that interactive word walls in the middle school classroom served as an effective instructional tool for science teachers.
Word walls help students understand science concepts, science-related vocabulary as well as general academic vocabulary, and are particularly helpful for English language learners (ELLs). Word walls also helped students recognize words, see patterns and relationships between words, and promote independent work habits. Word walls are one example of how K-12 teachers can manipulate the artifacts in their classroom environment and visually design their walls and/or bulletin boards in a way that increases language acquisition. Teachers at the elementary, middle

school, and high school levels failing to utilize classroom walls may be unintentionally doing a great disservice to their EL populations and missing opportunities to elicit engagement and achievement.

Environment and Academic Achievement

The way a classroom environment is designed can correlate to academic achievement. The presentation of a teacher's walls, furniture, supplies, and cleanliness has the ability to spark creativity, autonomy, and knowledge within students, positively impacting academic achievement (Asiyai, 2014; Durmus, 2016; Han et al., 2019; Sahin & Top, 2015).

One of the earliest studies to record the impact a classroom environment can have on academic achievement is from Kephart and Floyd's (1954) examination of classroom environment and how it related to 4th and 5th grade students' school achievement, posture, and frequency of nervous habits. The researchers made three major changes to two classrooms: distribution of light was rearranged so that the quantity and quality of light was distributed equally, the amount of contrast between the visual task presented to the child and its surrounding was minimized (i.e. all wood finished in light stain, light paint, yellow green boards rather than black boards), and furniture was changed to permit freedom of movement to the children and placed in slightly curved rows rather than straight rows to prevent undesirable shadows. Kephart and Floyd (1954) found that the experimental classes showed higher academic achievement, better posture, and a decrease in nervous habits compared to the control classes.

Many more recent researchers affirm and observe the impact that a classroom environment can have on academic achievement. Classroom environments designed

around cognitive, behavioral and emotional domains appear to maximize academic returns. Qijie (2017) studied which components of a classroom should be engaging to maximize academic achievement when he evaluated whether to design a classroom around academic content versus core competencies involving cognition, behavior, and emotion. The author determined that teacher leaders should design their class around competencies rather than content because students who are competent in cognition, behavior, and emotion will have a more enriching and rigorous experience when engaging with their content. Students surrounded by an environment designed to promote cognitive processes, autonomy, and positive emotion are more likely to engage and connect with their learning and understand a lesson the first time it is presented.

Classroom environments that are student-centered have students with higher academic achievement and engagement. Sahin and Top (2015) discovered that making the students take center stage in the classroom in the form of presentations and collaborative groups helped students learn the subject(s) better, promoted interest in STEM concepts, and refined skills for future careers. Educator leaders who want to ignite interest in STEM fields may want to design a classroom environment that is set up to facilitate structured student interactions where students rely on one another to discover, learn, and present information. A classroom environment conducive to student presentations and student voices is one where students feel welcome, safe, and valued within the learning space.

Certain physical classroom environments may also enhance students' critical thinking skills. In a research article studying 351 teachers in primary and secondary schools in Kutahya City on how learning environment characteristics and classroom

environment characteristics support critical thinking, Tunca (2015) found that aligning the classroom environment with constructivist learning environment characteristics is effective in supporting critical thinking. Classrooms designed to allow students to construct their own knowledge, providing them with the adequate visual support and resources needed, demonstrates the physical learning environment's ability to facilitate deep cognitive processes and elicit higher academic achievement.

The way a classroom is decorated, with furniture arranged optimally are elements of a learning environment that impacts academic achievement. In a study on constructing learning environment indicators for administrators observing teachers, Chen et al. (2016) found three major indicators for instruction leadership: classroom decoration, teacher-student interaction, and learning atmosphere. Sahin et al.'s (2011) research validates these indicators for instructional leaders in a study on the physical environment and classroom management in elementary schools. The authors found that the physical environment of the classroom was influential to classroom management, specifically the physical features, security function, and furniture and equipment. Teachers who were able to display students' work claimed that it motivated their students and had a positive influence, echoing Sahin and Top's (2015) research that urges classrooms to be student-centered. Students in classrooms with pristine physical environments experience higher levels of academic achievement than peers who learn in non-decorated, poorly furnished learning spaces.

Although Cavanagh (2015) examined 1760 surveys from secondary school students and found that an effective learning environment engaged students in classroom learning, there is much room to better define what comprises an effective learning

environment and how it engages students in their learning. There is no existing literature from the United States that has examined the impact that classroom design, defined as a classroom's organization of teacher and students' supplies, bulletin board displays including word walls, visual academic poster supports, posted incentive systems, posted rules and expectations, and class theme, has on secondary mathematics students' academic achievement and perceptions of their teacher. Due to this gap in the literature, many secondary school districts lack expectations about the classroom environment, and there is little to no support or materials for teachers to optimally design a space around students' learning needs.

Summary

This chapter presented a literature review that outlines the importance of the classroom environment and how it can positively impact language acquisition, academic achievement, and favorable perceptions. The first of three sections in this chapter discussed how one's perceptions could influence behavior, achievement, and motivation. The second section highlighted how the physical classroom environment, specifically through the use of word walls, has been shown to improve English language acquisition. The third section revealed how the physical classroom environment has affected academic achievement. Positive follower and student perceptions of their leader leads to increased motivation, higher achievement, and better behaviors. The next chapter includes an overview of the methodology used in this study including research method, research design, instruments, participants, data analysis methods, limitations, and delimitations.

CHAPTER 3: METHODOLOGY

This chapter includes a discussion of the research approach and methodology in the study. It is useful to restate the purpose of the study and research questions to justify the most appropriate methodology. The purpose of this study is to determine the impact that the design of classroom walls and organization has on students' perceptions of a teacher as a leader and students' academic achievement. This study addresses the following research questions:

1. What is the difference in mathematical academic performance, as measured by scores on a common formative assessment, between public high school students who learned math in a well-organized and well-designed classroom and students who learned math in an unorganized and non-designed classroom?

    1a. What is the difference in mathematical academic performance, as measured by scores on a common formative assessment, between English-only students and English learners who learned math in a well-organized and well-designed classroom and students who learned math in an unorganized and non-designed classroom?

    1b. What is the difference in mathematical academic performance, as measured by scores on a common formative assessment, between Short Term English Learners (STELs), Long Term English Learners (LTELs), and Reclassified English Proficient students (RFEPs) who learned math in a well-organized and well-designed classroom and

students who learned math in an unorganized and non-designed classroom?

2. What is the difference in public high school students' perceptions of teacher leadership between a teacher in a well organized and designed classroom and a teacher in an unorganized and non-designed classroom?

While there are qualitative, quantitative, and mixed method methodologies to research, the quantitative approach is best suited for this study because of its emphasis on numerical data in comparing averages on mathematical academic performances and rating differences from a frequency scale perceptions survey on a teacher's leader behaviors. Comparing responses between the control and treatment groups is best measured through numbers, averages, comparing averages, and drawing conclusions based on raw numbers and statistical tests. The quantitative approach is also more conducive to a sample size greater than 30 (Mason, 2010).

Research Method

A quantitative methodology with a causal comparative design was used for this research study because a teacher-created mathematical test and valid leadership questionnaire was used to assess the impact of a physical classroom's effectiveness without random selection. A group comparison was used to determine the impact, if any, of the design of a secondary teacher's physical classroom environment on students' leadership perceptions of the teacher and students' mathematical performances. The definition of a designed classroom environment used for this study is found in the Definition of Key Terms section of Chapter I of this study. The data from the control and treatment groups was compared in terms of between-group mean differences on students'

perception ratings of a teacher as a leader and students' common formative assessment scores from a math test on solving equations and related vocabulary graded on a rubric.

Research Design

A quantitative, causal comparative research design is used for this dissertation study because this study utilizes and analyzes numerical data using specific statistical tests to answer questions like who, how much, what, where, when, how many, and how. It also helps explain phenomena through gathering data in numerical form. The causal comparative design is best suited for this research study because it examines differences between groups, analyzing the differences between the control and treatment groups that took place in different classroom environments without random selection. A causal comparative design is also superior as it is used to examine relationships between variables, like the presence of a well-designed physical classroom environment, and is used to describe conditions that already exist (Apuke, 2017).

The study included an examination of the differences in students' academic performance and perceptions of their teacher as a leader between the control and treatment groups. This research design aligns with a causal comparative approach because of its intent to examine the differences between these student groups without random selection and without random assignment (Apuke, 2017). The researcher was the teacher, and the sample was selected based on convenience and the researcher's access to these students due her employment in the public high school. The classes of students and the classrooms already existed as preexisting conditions, also consistent with the causal comparative, quantitative research design.

Study Procedures

The research design involved one teacher teaching two class periods of Integrated Math II students in two different physical environments to determine whether the environment had an effect on students' perceptions of the teacher as a leader and their academic achievement on a mathematical assessment. The two classes were composed of about 50% English learners. The researcher was the teacher who worked closely with the school administration and counseling department to change the room number on students' schedules in the control group to help with the believability that the neglected classroom was the teacher's actual classroom environment. The study required that students take the perception survey about the teacher leader thinking that the teacher was the owner of the classroom environment in which the class took place. The researcher worked together with school administration to review the master schedule and select an available classroom that appeared neglected and disorganized during either 5th or 6th period since these were the classes selected for the study based on their similar time of day. Once the researcher chose a neglected classroom environment, the head counselor changed students' schedules in the selected period to reflect this new classroom number before the first day of school and administration provided the teacher with a key to this classroom. Changing students' schedules and providing the teacher with full access to the classroom improved the illusion that this classroom belonged to the teacher researcher.

The study took place at the start of a new school year to maximize the believability that the neglected classroom environment belonged to the teacher. It would not make sense to conduct the study at any other time of the school year because students would already be introduced to the teacher's home classroom environment. All students

in this study, except two from period 5, the control group, had not worked with the teacher prior to the study, which helped to avoid any preconceptions students may have had about the researcher or her class. The point of the study was for students to temporarily learn and judge the teacher based on a classroom environment that they perceived the teacher owned.

Conducting this study at the beginning of the school year was also an ethical consideration because the content that was assessed for this study included reviewing how to solve equations, and this topic is not Integrated Math II mathematical content. Students in the control group, learning in a subpar classroom environment, were not at risk for losing out on receiving best teaching and learning practices during Integrated Math II coursework. They were not at greater risk for failing the class or at risk for receiving a lower grade than the treatment group who learned in the optimally designed classroom environment.

In order to ensure the classes in the study began at the same mathematical level, a pretest was administered the first week of school that was the same test administered at the end of the unit. After administering the pretest, the researcher used an independent two-samples t-test and a Mann-Whitney U test to make sure there were non-statistically different scores between the two classes at the onset of the study. If there were statistically different scores in the pretest between the two classes, then the results of the study would be invalid due to a preexisting difference between groups that has nothing to do with the physical environment. If there were not statistically different scores in the pretest between the two classes, any statistical difference found in the math posttest may

be attributed to the condition difference, which was a well-designed and organized classroom environment.

No statistical difference was found in the pretest so the researcher proceeded with teaching the unit and then administering the posttest. The teacher conducted class in each class period in exactly the same way. Introductions and icebreakers took place the first couple days, followed by a review of rules and procedures, a review of foundational mathematical knowledge on solving equations, and then an assessment of students' mastery on solving equations. This is typical pacing for the teacher based on the past five years of teaching Integrated Math II. The study ended once the assessment on solving equations was complete. The test took students one class period to complete, and did not count against students' grades.

Before administering the posttest on how to solve equations, the teacher reviewed how to solve equations with both class periods uniformly. Students took notes, wrote vocabulary words and definitions in their journals, learned a song, and practiced with written examples and interactive whiteboard games. Both classes were able to use their notes and a calculator on the test. The teacher placed the vocabulary words on the word wall in the optimally designed classroom (Appendix C, photos 24-25). The optimally designed classroom also displayed a poster with a multiplication chart, adding and subtracting negative numbers hint poster, and multiplying and dividing negative numbers hint poster (Appendix C, photos 18-19). While students in the optimally designed classroom were able to look at these posters during the assessment and students in the neglected classroom were not, all students had access to a calculator that provided support in adding, subtracting, multiplying, and dividing positive and negative numbers.

In the interest of minimizing risk and conducting ethical research, once the data was collected in the first three weeks of the school year, the Integrated Math II class that took place in the neglected classroom environment moved to the researcher's personal classroom environment that served as the treatment group's classroom, optimally decorated, organized, and set up to support student success. The researcher destroyed all identifiers of the participants as soon as the data was collected so that none of the academic assessment scores would be traceable to individual students. The students were not penalized for poor assessment scores during the study and none of the academic material covered in the first two weeks of school was Integrated Math II content, so this did not set the control group back in any way.

The researcher also administered the multi-rater form of the Multifactor Leadership Questionnaire (MLQ) through an online link sent to students' school email addresses (see instructions and sample questions in Appendix A). The data and raw scale scores were collected through Survey Monkey, an online software system. All responses from the survey were exported into a Microsoft excel spreadsheet. Each participant remained anonymous during the data collection process. On the MLQ, students rated their perceptions of the teacher's leadership behaviors on a frequency scale. The researcher administered the MLQ as soon as consent forms were received in the interest of capturing students' earliest impressions of the teacher when the environment may have the greatest impact on student responses before students have a higher number of social interactions with the teacher, learn more about the teacher's background, or form a relational bond.

Instruments

The responses to the Multifactor Leadership Questionnaire (MLQ) and assessment scores supply the data for this study. The instrument to measure mathematical academic achievement is an assessment the teacher/researcher created that requires the use of vocabulary and algebra to solve equations. The researcher graded the assessment using a rubric. Figure 1 shows the assessment. As soon as the researcher collected the assessments, they were labeled with the student's English-learner status, or other at-risk status, and then the top of the paper that included the name was cut off in order to lose any possible identifiers that could compromise students' anonymity. Figure 2 shows the rubric that was used to grade the assessment.

The researcher served as the evaluator for what defines an organized and unorganized classroom environment as defined in the key terms in chapter 1 of this dissertation. Pictures of both classroom environments used for the control and treatment groups are provided in appendices B and C to allow the reader to note the differences in design and organization within the classroom spaces. The researcher is sufficient to determine what constitutes organized and unorganized because the operational definition of organized in this study includes 0-10 items out of place at any given time. The researcher is able to determine and provide picture evidence of what items are considered out of place and classify the classroom as organized or not. Zero items pictured in the treatment classroom are out of place (Appendix C, photos 4, 5, 6, 7, 10), allowing the researcher to classify it as an organized environment, while items like a hanger, grocery bag, extension cords (Appendix B, photo 9), power strips (photo 9 and 13), case of posters (photo 3), irrelevant posters and flags [irrelevant to mathematics] (photos 1 and

14), unused, boxed printer (photo 12), money box, polling place sign (photo 7), cluttered supply station near the door with a bowl and basket on the floor appearing out of place (photo 3), and wired supply cart (photo 13) appear out of place and/or unorganized in the control classroom, allowing the researcher to classify it as an unorganized environment.

Teacher-Created Equations Assessment

The teacher/researcher created an assessment in order to assess specific vocabulary and mathematical processes reviewed in the first few weeks of the school year. There are four open-ended questions on the assessment survey with problem 4 consisting of two parts. There is an academic vocabulary component to the assessment and a computational component to the assessment, as both are needed to show mastery.

The response scaling on the equations assessment is open-ended and graded on a rubric scale from 4 or 5 points to 0. Questions 1, 3, and 4b have a maximum score of 4 points while questions 2 and 4a have a maximum score of 5 points (see figure 2). Each assessment is graded out of a total of 22 points and each participant's score for each question is also itemized. Assessment items 2, 3, and 4b are open-ended in the sense that they require students to show their algebraic work to isolate x in solving the equation. Assessment items 1 and 4a are open-ended in the sense that students must accurately label (question 1) vocabulary terms and use vocabulary to accurately explain how to solve an equation (question 4a). Assessment items 1 and 4a require attention to writing, words, and vocabulary compared to assessment items 2, 3, and 4b that require accuracy in regards to numerical work. All questions on the teacher/researcher-created assessment are open-ended and are graded on a rubric scale.

Validity and Reliability

All responses on all assessments were graded using an objective rubric scale (figure 2). In assessment methods where students' constructed responses cannot be evaluated with complete objectivity, rubrics are considered an effective approach for achieving reliable and valid professional judgment of students' performances (Dogan & Uluman, 2017; Pellegrino et al., 1999; Reddy, 2011). Popham (1997) adds that valid and reliable rubrics contain three essential features: (a) evaluation criteria, (b) quality definitions, and (c) scoring strategy. According to Reddy (2011), a rubric developed with clear evaluation criteria, quality definitions, and scoring strategy can be used as a pretest-posttest measure, wherein students' performance on the criteria can be collected in the beginning of a program and then again towards the conclusion of the program. Pretest and posttest rubric data can inform students about their progress over time, teachers about effectiveness of instruction and course design, and administrators about the quality of a given program. The rubric created to grade the assessments in this study includes clear evaluation criteria, quality definitions, and scoring strategy in the interest of maximizing reliability and validity as a data-gathering instrument.

Figure 1

Pre- and Posttest to Measure Academic Achievement

Name: _____Period: _____ Integrated Math II

Equations Assessment

1) Label the ***coefficient, constant, variable, and terms*** in the expression below:

$-4x + 7$

2) Solve for the value of x.

$5(3x - 2) = 2(x - 2) + x$

3) Solve for the value of x.

$4x + 7 + 3x = -14$

4) a. Write sentences using the vocabulary words ***distribute, constant, coefficient, isolate, and variable*** to explain how you would solve the following equation: $4(3x+5) = 44$

_____
_____
_____
_____
_____
_____

b. Show your work to solve for the value of x: $4(3x+5) = 44$

Figure 2

#	Points					
1	**4** Student correctly labels **coefficient, constant, variable, and terms**.	**3** Student correctly labels 3 of 4 vocabulary words listed left.	**2** Student correctly labels 2 of 4 vocabulary words listed left.	**1** Student correctly labels 1 of 4 vocabulary words listed left.	**0** Student correctly labels 0 of 4 vocabulary words listed left. OR No attempt	
2	**5** Student shows: (1)Correct distribution of 5 to get 15x-10 (2) correct distribution of 2 to get 2x-4 (3) Get to step 12x=6 (4) Get to x= 6/12 (5) Get to x= 1/2	**4** Student only shows 4 of 5 correct items listed left. OR Student incorrectly distributes 1 of 2 items but then shows all correct work to continue solving for x.	**3** Student only shows 3 of 5 correct items listed left. OR Student incorrectly distributes both items but then shows all correct work to continue solving for x.	**2** Student only shows 2 of 5 correct items listed left.	**1** Student only shows 1 of 5 correct items listed left.	**0** Student shows 0 of 5 correct items listed left. OR No attempt
3	**4** Student shows (1) correct combining like terms to get 7x+7=-14 (2) subtract 7 from both sides of equal sign (3) Get 7x=-21 (4) correct final answer of x=-3	**3** Student only shows 3 of 4 correct items listed left. OR Student incorrectly adds -14+-7 but still shows remaining correct work to solve for x.	**2** Student only shows 2 of 4 correct items listed left.	**1** Student only shows 1 of 4 correct items listed left.	**0** Student only shows 0 of 4 correct items listed left. OR No attempt	
4a	**5** Student correctly uses the words **distribute, constant, coefficient, isolate, and variable** to explain how to solve the equation.	**4** Student correctly uses 4 of 5 words listed left to explain how to solve the equation.	**3** Student correctly uses 3 of 5 words listed left to explain how to solve the equation.	**2** Student correctly uses 2 of 5 words listed left to explain how to solve the equation.	**1** Student correctly uses 1 of 5 words listed left to explain how to solve the equation.	**0** Student correctly uses 0 of 5 words listed left to explain how to solve the equation. OR No attempt
4b	**4** Student shows (1) correct distribution 12x + 20 (2) subtract 20 from both sides of equal sign (3) divide by 12 from both sides of equal sign (4) correct final answer of x=2	**3** Student shows incorrect distribution, but still solves (incorrect) equation correctly, showing ALL work OR Student only shows 3 of 4 correct items listed left.	**2** Student only shows 2 of 4 correct items listed left.	**1** Student only shows 1 of 4 correct items listed left.	**0** Student shows 0 of 4 correct items listed left. OR No attempt	

Note. This is the rubric used to grade the equations assessment. The elaboration of each point breakdown reduces researcher bias during grading and data analysis.

Multifactor Leadership Questionnaire (MLQ)

The Multifactor Leadership Questionnaire (MLQ) multi-rater form is the instrument used to measure students' perceptions of the teacher as a leader (see Appendix A). The MLQ is a valid and widely used survey instrument to assess followers' perceptions of a leader (Avolio & Bass, 2004). Students received a link to the survey through their school email. The survey included a frequency scale where students rated the teacher as a leader in terms of 45 leadership behaviors like "heightens my desire to succeed", "acts in ways that build my respect", and "leads a group that is effective". The response scaling on the survey items include a 0-4 response frequency scale from "not at all" to "frequently, if not always" with a "sometimes" middle point. All survey items were multiple-choice where participants clicked the option that corresponds to the frequency that they observe regarding the teacher's leadership. Responses were recorded through a secure data collection company called Survey Monkey. The researcher has access to individual and group scores through a secure login.

Validity and Reliability

Descriptive statistics and reliabilities for the Multifactor Leadership Questionnaire (MLQ) are shown in Table 1 for all items in each scale for the initial sample set (Avolio & Bass, 2004). Table 1 demonstrates the 1999 samples summary of Confirmatory Factor Analysis (CFA) results with the left column representing fit indices that include Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI) and Root Mean Squared Residual (RMSR), Normed Fit Index (NFI) and Tucker-Lewis Index (TLI). The seven leadership factors horizontally along the top of the table include: charisma, inspirational, intellectual stimulation, individualized consideration, contingent reward,

management-by-exception, and laissez-faire. Confirmatory Factor Analysis is a commonly used technique for testing the psychometric properties of measurement instruments because it tests a pre-specified factor structure and the goodness of fit of the resulting solution (Bagozzi et al., 1991; Kenny & Kashy, 1992). The scale scores in Table 1 are based on ratings by others evaluating a target leader from the initial set of nine samples (N = 2,154) reported in the 1995 MLQ Technical Report. No self-ratings are included. Reliabilities for the total items and for each leadership factor scale ranged from .74 to .94. All of the scales' reliabilities were high, exceeding standard cut-offs for internal consistency. Table 1 also presents the reliabilities for each leadership factor broken down for each individual sample. The reliability within each data set generally indicated that the MLQ was reliably measuring each of the leadership factors.

Table 1

1999 Normative Samples Summary of CFA Results

Note. Taken from Avolio and Bass (2004) to show the validity and reliability of the MLQ.

Model	1 Factor	2 Factors: Active vs. Passive	2 Factors: Transformational vs. Non Transformational	3 Factors	4 Factors	5 Factors	6 Factors	7. Factors
Chi-square	5674 (6859)/594	3509 (3676)/593	5260 (5509)/593	3528 (4229)/591	2907 (3188)/588	2790 (3178)/584	2509 (2788)/579	2497 (2769)/573
GFI	75 (67)	86 (85)	77 (77)	86 (82)	89 (88)	89 (88)	91 (91)	90 (91)
AGFI	72 (63)	84 (84)	74 (75)	84 (80)	87 (86)	87 (86)	90 (89)	90 (89)
RMSR	07 (09)	05 (06)	08 (11)	05 (07)	04 (06)	04 (06)	04 (05)	04 (05)
NFI	80 (75)	87 (87)	81 (80)	87 (85)	90 (88)	90 (88)	91 (90)	91 (90)
TLI	79 (73)	87 (73)	80 (79)	87 (83)	89 (87)	88 (87)	89 (88)	89 (88)

Participants

The participants in this study included two classes of public high school students enrolled in Integrated Math II in a Pacific Southwestern city. Both classes were Structured English Immersion (SEI) classes, meaning over 30% of the students in the class are English learners. Both classes had the same teacher. The researcher was the teacher. The sample was selected based on convenience and the researcher's access to these students due to employment in the public high school. The sample size was n=63 students for the equations test, 30 from the control group and 33 from the treatment group, and n=61 students for the MLQ, 28 from the control group and 33 from the treatment group.

Table 2

Gender of Participants

Pre- and Posttest n =63		
	Male	**Female**
Period 5 Control Group n=30	14	16
Period 6 Treatment Group n=33	16	17
Multifactor Leadership Questionnaire n=61		
	Male	**Female**
Period 5 Control Group n=28	12	16
Period 6 Treatment Group n=33	16	17

Table 3

Grade Levels of Participants

Pre- and Posttest n =63				
Grade level	**9th**	**10th**	**11th**	**12th**
Period 5 Control Group n=30	6	21	3	0
Period 6 Treatment Group n=33	2	27	2	2
Multifactor Leadership Questionnaire n=61				
Grade level	**9th**	**10th**	**11th**	**12th**
Period 5 Control Group n=28	6	20	2	0
Period 6 Treatment Group n=33	2	27	2	2

The control and treatment groups align nicely in terms of sharing similar numbers of English learners. The control group (n=30), period 5, contains 16 total ELs: 2 STELs, 7 LTELs, and 7 RFEPs for a class percentage of 53%, while the treatment group (n=33), period 6, contained 16 total ELs: 3 STELs, 5 LTELs, and 8 RFEPs for a class percentage of 48%. The control group included one student with an IEP and zero 504 plans, while the treatment group contained zero students with IEPs and 2 students with 504 plans.

Table 4

Breakdown of Learner Profiles in Pre/Posttest Data N=63

Control Group Period 5 Integrated Math II Student Profiles n=30		Treatment Group Period 6 Integrated Math II Student Profiles n=33
7	LTEL	5

Control Group Period 5 Integrated Math II Student Profiles n=30		Treatment Group Period 6 Integrated Math II Student Profiles n=33
7	LTEL	5
2	STEL	3
7	RFEP	8
1 (also counted in EO)	SARB	0
1 (also counted in LTEL)	IEP	0
0	504 plan	2 (1 also counted in LTEL and 1 counted in EO)
14	EO	17

Note. LTEL stands for Long-Term English Learner and classifies a student who has been in the United States for more than six years and is still not yet English proficient, STEL stands for Short-Term English Learner and stands for students who are not yet English proficient and have been in the United States less than six years, RFEP stands for students who are Reclassified as English Proficient, SARB stands for School Attendance Review Board and is used for students who have low attendance, IEP stands for Individualized Education Plan and is used to provide modifications and accommodations for students with special needs, and 504 plan stands for Section 504 of the Rehabilitation Act of 1973 to remove barriers and allow students with disabilities to participate freely in education. EO stands for English-only. In the control group, there are two students double counted because they have a profile that includes EO and SARB and LTEL and IEP. In the treatment group, there are two students double counted because one student has a 504 and is EO, while another student has a 504 and is also a LTEL.

Table 5

Breakdown of Learner Profiles in MLQ Data N=61

Control Group Period 5 Integrated Math II Student Profiles n=28		Treatment Group Period 6 Integrated Math II Student Profiles n=33
5	LTEL	5
2	STEL	3
7	RFEP	8
1 (also counted in EO)	SARB	0
1 (also counted in LTEL)	IEP	0
0	504 plan	2 (1 also counted in LTEL and 1 counted in EO)
14	English-only	17

Note. This table is the same as table 4 except for the change in the number of LTELs in the control group (period 5), dropping from 7 to 5. The reason for this change is explained below.

There are two more participants in the pre- and posttest data (n=63) compared to the MLQ data (n=61) because two students in the control group (period 5) were already familiar with the researcher's home classroom, where the treatment group took place. One was part of an afterschool program that took place in this classroom environment two years prior (August 2019-March 2020). This study participant is a male junior from the period 5, control group, who is also an LTEL. The other participant excluded from the MLQ data attended class in the teacher's home classroom when the school returned to in-

person instruction for the last 5 weeks of the 2020-21 school year (May-June 2021). This study participant is a male sophomore who is also an LTEL. The researcher did not include their responses about their perceptions of the teacher as a leader since their perceptions may be swayed by past experiences with the teacher and their knowledge of the decorated and organized classroom environment.

These two participants were included in the pre- and posttest data because this assessment is separated and unrelated to past interactions and/or perceptions of the teacher as a leader. Neither of these students have prior experience with the teacher researcher as their math teacher before. The equations test assessed how well the students understood the material while learning in a given classroom environment. The two students who were exposed to the teacher's nicely organized and decorated classroom in the past were not at risk for swaying the results on the test as there would be no unfair advantage or breach of validity in assessing a student on how to solve equations due to past exposure to the teacher's organized classroom environment.

The control and treatment groups aligned nicely in terms of sharing similar numbers of English learners in the MLQ data. The control group (n=28), period 5, contained 14 total ELs: 2 STELs, 5 LTELs, and 7 RFEPs for a class percentage of 50%, while the treatment group (n=33), period 6, contained 16 total ELs: 3 STELs, 5 LTELs, and 8 RFEPs for a class percentage of 48%.

Two groups of participants were studied to analyze the impact of a classroom environment on students' perceptions and academic performance: (1) those who met the teacher and took Integrated Math II in a well organized and well-designed classroom (treatment group, period 6), and (2) those who met the teacher and took Integrated Math

II in an unorganized and non-designed classroom (control group, period 5). The control group was composed of one class period of students who took the class in a non-decorated classroom. The treatment group was composed of one class period of students who took the class in a decorated classroom. The school bell schedule was such that the teacher saw class periods 1, 2, 3, 4, 5, and 6 for about 58 minutes every day, Monday through Friday. The classes were as similar as possible for comparison and took place at similar times during the school day, both after lunch. The control group had class from 12:45p.m.-1:45p.m., while the treatment group had class from 1:50p.m.-2:50p.m. The pace of the material and content covered each day was the same in each class.

Data Analysis Methods

Hypothesis 1 Assessment Scores

Analyzing assessment data relevant to hypothesis one requires an independent two-samples t-test as a type of inferential statistic used to determine if there is a significant difference between the means of two groups (Salkind, 2017), and it is quantitative in nature. This t-test involves group comparison because one group's experience took place in a different context than the other and data from both groups produced mean scores from the assessment. An independent two-samples t-test was utilized to compare the mean academic performances between the two groups using a 0.05 Type I alpha error rate. The assessment includes four short answer questions that the teacher graded on a rubric. The means of each data set were compared using an independent two-samples t-test with the Excel data analysis package.

There are assumptions associated with an independent two-samples t-test. An independent two-samples t-test requires that the dependent variable be normally

distributed within each group. The researcher tested whether the dependent variable was normally distributed with a Shapiro-Wilks test of normality on the pre and posttest data and discovered that the data violates the assumption of normal distribution. An assumption of homogeneity is also associated with an independent two-samples t-test, assuming the variances of the two groups are equal in the population. The researcher tested the assumption of homogeneity of variance using an F-test two-sample for variance only to find the data also violates the assumption of equal variance. As a result of the violation of normal distribution and equal variance assumptions needed to conduct t-tests, a Mann-Whitney U test was also utilized to compare the data, as assumptions of normal distribution and equal variance are not required to conduct this statistical test. The researcher conducted both an independent two-samples t-test assuming unequal variances and a Mann-Whitney U test on the data to compare averages.

Hypothesis 2 Perceptions Survey Ratings

The researcher used Multifactor Leadership Questionnaire (MLQ) survey data to address hypothesis two and used Microsoft Excel to run a Mann-Whitney U test to compare whether there was a difference in average ratings on the teacher's perceived leadership behaviors between the control and treatment classes. A Mann-Whitney U test using a 0.05 Type I alpha error rate is best because the researcher received responses from the MLQ survey that were ordinal variables; therefore a non-parametric test was appropriate. This test shows whether there is a difference in average ratings between the two separate class periods. The variance of these groups is studied to allow for inferences to be made about the broader population from the samples that were surveyed.

There are four assumptions that must be met when using a Mann-Whitney U test. The first assumption is that there is one dependent variable measured at the ordinal level. This is characteristic of the MLQ survey because it uses a frequency scale with ordinal measurements. The second assumption is that there is one independent variable that consists of two independent groups. The two groups in this study were two separate class periods that took place in different classroom environments, and the classroom environment served as the independent variable. The third assumption is independence of observations, which means that participants in each group must be separate and cannot intersect. This is a characteristic of this study as the students cannot be in both classes at the same time. The fourth assumption involves determining whether the distribution of scores for both groups has the same shape or different shape as the shape will signal whether there are differences in the distributions of two groups or differences in the medians of two groups. Different shapes of the graph mean the Mann-Whitney U test determines whether there are differences in distribution, while graphs that are the same shape mean the Mann-Whitney U test determine whether there are differences in the medians of two groups. The researcher evaluates these assumptions by graphing and comparing the mean ranks of each distribution of scores.

Limitations

The study has its limitations due to the inability of the researcher to have two different groups of identical students/class periods. This creates unavoidable variability between the students who comprise the two classes. The study is also limited because the researcher is not able to conduct the study with random selection. These classes are pre-assigned to the teacher from the master schedule at the high school. There is no way for

the researcher to randomly select a class within the school or school district. This study is also limited to mathematics, and may have different results in other subject areas and/or more affluent areas of the community. It is also impossible to conduct both classes at the same time of day with the same teacher or in the exact same classroom with features such as the same number of windows, the same orientation of where the door, windows, whiteboards, and student desks and chairs are set up. The furniture itself is also different, as well as the projector quality and age of the buildings. These elements create many additional potential variables in the study.

The researcher, who is also the teacher, creates another potential limitation of the study in terms of researcher/teacher bias. One may argue the teacher could teach the experimental group in the well-decorated class better and with more passion than the control group in the non-decorated classroom. In order to mitigate this limitation, the teacher used the same script when teaching both classes. The results of this study might not be generalizable to high school students in other schools or areas around the country because of these limitations.

Delimitations

Boundaries were placed on the study to narrow the population and measure the impacts of a classroom's organization and design on urban public high school math students. The decision to narrow the study to only two math classes was made to constrict the range of teachers and course subjects. The decision to use Structured English Immersion (SEI) classes in the study was made to narrow the focus to English learners within the at-risk student category. Boundaries were also placed on how many mathematical assessments are analyzed. The study was an acute, rather than long-term

study because of the potential ethical problems associated with teaching one group of students in a better environment than another for an extended period of time. The common formative assessment is used in the study, but not actually entered into each student's grade because one learning environment may be advantageous to another and the experimental group should not be penalized for learning in an inferior environment. After the posttest that took place during the third week of the school year, all students resumed class in the nicely organized and decorated classroom since the researcher hypothesizes that this is an optimal learning environment and this is the teacher's home classroom. Due to these boundaries, the findings and results of this study may not be generalizable to other subjects, locations, or future time periods.

Summary

This chapter presented why a quantitative, causal comparative research method is best suited for this study. Not only is quantitative research better for studies with sample sizes larger than 30 (Mason, 2010), quantitative research is best for this study because of its attention to numerical data examining between group average differences. Quantitative statistical tests, namely the independent two-samples t-test and Mann-Whitney U-test, most directly answer the research questions of whether a classroom environment affects high school students' perceptions of their teacher as a leader and their mathematical achievement. This chapter also mapped out the data collection strategy to include a pencil and paper mathematical assessment and an online administration of the Multifactor Leadership Questionnaire (MLQ) before discussing the steps taken to minimize risks to the participants. Data analysis procedures and an outline of limitations and delimitations were also addressed.

CHAPTER 4: FINDINGS/RESULTS

Chapter four includes a presentation of findings and a presentation of results of the quantitative data gathered from the pre- and post- math test assessments and the Multifactor Leadership Questionnaire (MLQ) survey. The quantitative data from 63 high school students' math tests scores addresses hypotheses #1, 1a, and 1b about whether there are statistically significant higher assessment averages among the secondary mathematics students, English-only students, and English learners in an organized and well-designed classroom environment than students in an unorganized and non-designed classroom environment. The researcher predicted to utilize an independent two-samples t-test to compare the data, but ended up using both an independent two-samples t-test and a Mann-Whitney U test to compare the data because the data violated the assumptions of normal distribution and equal variance required to perform the independent two-samples t-tests. Sixty-one high school students' average survey scores on the MLQ addresses hypothesis #2, which poses whether secondary mathematics students' perception ratings of their teacher's leadership will be significantly higher in the presence of a teacher's organized and well-designed classroom than in the presence of a teacher's unorganized and non-designed classroom. A Mann-Whitney U test was used to determine if there was a statistically significant difference between the survey scores of the two groups.

Presentation of Findings

Academic Achievement: Test on Equations

Pretest

The first set of data includes Integrated Math II students' pretest assessment scores for the control group (period 5) and treatment group (period 6). The control group (period 5) was conducted in the unorganized and undecorated classroom environment while the treatment group

(period 6) was conducted in an organized and decorated classroom environment (see Appendix B and C for pictures of each classroom environment, respectively).

A pretest was administered to ensure the initial means of the two groups of students were the same before the research was conducted. This way, if mean differences were found in the posttest data, this would likely be a result of the variable under examination in the study rather than the result of a pre-existing difference between the two groups. Once the pretest data was collected, a Shapiro-Wilks test of normality was conducted to ensure normal distribution. Next, a two-sample F-test for variances was conducted to ensure equal variance.

Overall Performance. Tables 6-10 show the overall performance of all students in the control (period 5) and treatment (period 6) groups on the pretest. Total points for each period are presented, as well as the descriptive statistics for each group's scores. There is also a table of how each student performed itemized by each test question.

Table 6

Pretest Scores on Solving Equations

Student	Period 5 Pre Test Scores	Period 6 Pre Test Scores
1	1.00000	14.00000
2	11.00000	14.00000
3	8.00000	15.00000
4	0.00000	3.00000
5	7.00000	6.00000
6	3.00000	16.00000
7	20.00000	15.00000

Student	Period 5 Pre Test Scores	Period 6 Pre Test Scores
8	3.00000	9.00000
9	3.00000	12.00000
10	15.00000	4.00000
11	14.00000	14.00000
12	0.00000	2.00000
13	8.00000	10.00000
14	12.00000	13.00000
15	0.00000	12.00000
16	3.00000	0.00000
17	12.00000	1.00000
18	2.00000	16.00000
19	1.00000	4.00000
20	6.00000	14.00000
21	14.00000	16.00000
22	0.00000	0.00000
23	19.00000	6.00000
24	15.00000	11.00000
25	14.00000	7.00000
26	1.00000	7.00000
27	1.00000	16.00000
28	9.00000	21.00000
29	1.00000	16.00000

Student	Period 5 Pre Test Scores	Period 6 Pre Test Scores
30	22.00000	4.00000
31		0.00000
32		8.00000
33		12.00000

Note. The scores shown above were the total points scored on a rubric (figure 2) out of 22 total points on the test.

Table 7

Descriptive Statistics on Control Group Pretest

Period 5 Pre Test Scores (7.5±6.80644)					
N	30				
Mean	7.50000	*Mean Standard Error*	1.24268		
Mean LCL 95%	4.95843	*Mean UCL 95%*	10.04157		
Trimmed Mean (5%)	7.14815	*Geometric Mean*	4.46880	*Harmonic Mean*	3.63317
Median	6.50000	*Median Error*	0.28435	*Mode*	1.00000
Standard Deviation	6.80644	*Variance*	46.32759	*Coefficient of Variation*	0.90752
Range	22.00000	*Minimum*	0.00000	*Maximum*	22.00000
IQR	12.50000	*Percentile 25% (Q1)*	1.00000	*Percentile 75% (Q3)*	13.50000
Mean Deviation	5.86667	*Median Absolute Deviation*	5.00000	*Coefficient of Dispersion*	0.89744
Sum	225.00000	*Sum Standard Error*	37.28039		
Total Sum Squares	3,031.00000	*Adjusted Sum Squares*	1,343.50000		
Second Moment	44.78333	*Third Moment*	160.80000	*Fourth Moment*	4,096.99583
Fisher's Skewness G1	0.56521	*Skewness*	0.53655	*Skewness Standard Error*	0.41242
Fisher's Kurtosis G2	-0.90806	*Kurtosis*	2.04283	*Kurtosis Standard Error*	0.74858

Period 5, the control group, presents a mean of 7.5/22 on the pretest, which totals a score of 34%. The mode, and most common score on the pretest, was 1/22, a 4.5%.

Table 8

Descriptive Statistics on Treatment Group Pretest

Period 6 Pre Test Scores (9.63636±5.83534)					
N	33				
Mean	9.63636	*Mean Standard Error*	1.01580		
Mean LCL 95%	7.56724	*Mean UCL 95%*	11.70548		
Trimmed Mean (5%)	9.64983	*Geometric Mean*	7.23454	*Harmonic Mean*	6.96865
Median	11.00000	*Median Error*	0.22162	*Mode*	16.00000
Standard Deviation	5.83534	*Variance*	34.05114	*Coefficient of Variation*	0.60555
Range	21.00000	*Minimum*	0.00000	*Maximum*	21.00000
IQR	10.00000	*Percentile 25% (Q1)*	4.00000	*Percentile 75% (Q3)*	14.00000
Mean Deviation	5.06336	*Median Absolute Deviation*	10.00000	*Coefficient of Dispersion*	0.45455
Sum	318.00000	*Sum Standard Error*	33.52145		
Total Sum Squares	4,154.00000	*Adjusted Sum Squares*	1,089.63636		
Second Moment	33.01928	*Third Moment*	-38.29452	*Fourth Moment*	2,074.50853
Fisher's Skewness G1	-0.21157	*Skewness*	-0.20183	*Skewness Standard Error*	0.39606
Fisher's Kurtosis G2	-1.07722	*Kurtosis*	1.90274	*Kurtosis Standard Error*	0.72512

Period 6, the treatment group, presents a mean of 9.6/22 on the pretest, which totals a score of 43.6%. The mean deviation was very similar in both groups, 5.06 for the treatment group and 5.87 for the control group.

Table 9

Score Breakdown per Question for Control Group (Period 5) Pretest

P.5 whole class	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
1	1	0	0	0	0	1
2	3	0	3	2	3	11
3	3	5	0	0	0	8
4	0	0	0	0	0	0
5	3	2	0	1	1	7
6	3	0	0	0	0	3
7	3	5	4	4	4	20
8	2	0	0	1	0	3
9	3	0	0	0	0	3
10	3	2	1	5	4	15
11	2	2	4	2	4	14
12	0	0	0	0	0	0
13	2	0	0	2	4	8
14	4	2	1	2	3	12
15	0	0	0	0	0	0
16	0	1	2	0	0	3
17	1	0	4	3	4	12
18	0	0	0	2	0	2
19	0	0	0	1	0	1
20	1	0	3	2	0	6
21	0	4	4	2	4	14
22	0	0	0	0	0	0
23	3	3	4	5	4	19
24	3	2	2	4	4	15
25	1	5	4	2	2	14
26	1	0	0	0	0	1
27	1	0	0	0	0	1
28	1	2	0	2	4	9
29	1	0	0	0	0	1
30	4	5	4	5	4	22
p.5 AVERAGE						7.5

Note. Point values were based on the grading rubric provided in figure 2.

Table 10

Score Breakdown per Question for Treatment Group (Period 6) Pretest

P.6 whole class	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
1	1	2	4	3	4	14
2	3	2	4	1	4	14
3	3	0	4	4	4	15
4	3	0	0	0	0	3
5	3	0	0	2	1	6
6	3	4	3	2	4	16
7	0	5	4	2	4	15
8	1	2	2	0	4	9
9	1	5	2	0	4	12
10	0	2	0	0	2	4
11	3	2	1	4	4	14
12	1	0	1	0	0	2
13	0	4	2	0	4	10
14	1	4	2	3	3	13
15	0	3	4	1	4	12
16	0	0	0	0	0	0
17	1	0	0	0	0	1
18	1	4	4	3	4	16
19	3	0	1	0	0	4
20	0	4	4	2	4	14
21	3	5	4	0	4	16
22	0	0	0	0	0	0
23	1	3	0	2	0	6
24	3	2	0	2	4	11
25	3	0	0	4	0	7
26	1	2	2	0	2	7
27	2	3	4	3	4	16
28	3	5	4	5	4	21
29	2	5	4	3	2	16
30	3	0	0	1	0	4
31	0	0	0	0	0	0
32	0	3	3	0	2	8
33	2	1	2	3	4	12
p.6 AVERAGE						9.6363636

The treatment group presented a higher average (9.6) on the pretest compared to the control group (7.5) with a difference of 2.1 points or 9.5%.

Performance of English-Only Students. Table 11 shows the performance of English-only students on the pretest in both control (left) and treatment (right) groups.

Table 11

Pretest Scores per Question for English-Only Students

P.5 EO	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
6	3	0	0	0	0	3
7	3	5	4	4	4	20
10	3	2	1	5	4	15
13	2	0	0	2	4	8
14	4	2	1	2	3	12
17	1	0	4	3	4	12
20	1	0	3	2	0	6
21	0	4	4	2	4	14
23	3	3	4	5	4	19
24	3	2	2	4	4	15
25	1	5	4	2	2	14
26	1	0	0	0	0	1
27	1	0	0	0	0	1
30	4	5	4	5	4	22
AVERAGES	2.14285714	2	2.21428571	2.57142857	2.64285714	11.5714286

P.6 EO	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
1	1	2	4	3	4	14
2	3	2	4	1	4	14
4	3	0	0	0	0	3
6	3	4	3	2	4	16
9	1	5	2	0	4	12
12	1	0	1	0	0	2
14	1	4	2	3	3	13
17	1	0	0	0	0	1
18	1	4	4	3	4	16
20	0	4	4	2	4	14
23	1	3	0	2	0	6
24	3	2	0	2	4	11
25	3	0	0	4	0	7
28	3	5	4	5	4	21
30	3	0	0	1	0	4
31	0	0	0	0	0	0
33	2	1	2	3	4	12
AVERAGES	1.76470588	2.11764706	1.76470588	1.82352941	2.29411765	9.76470588

The English-only students in the control group averaged 11.6 points on the pretest, while the English-only students in the treatment group averaged 9.8 points. The 11.6 average score of the English-only students in the control group is notably higher than the class average of 7.5. The 9.8 average score of the English-only students in the treatment group aligns closely with the 9.6 overall class average. This data suggests the English learners and English-only students present similar achievement levels on the pretest in the treatment group, while the English-only students appear to outperform the English learners in the control group by 4.1 points, or 18.6%, on the pretest.

Performance of English Learners. Table 12 shows the averages of how English learners in the control group (left) and treatment group (right) performed on the pretest compared to English-only students in table 11.

Table 12

Pretest Scores per Question for All English Learners Combined (STELs LTELs, and RFEPs)

P.5 EL Student	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22	P.6 EL Student	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
1	1	0	0	0	0	1	3	3	0	4	4	4	15
2	3	0	3	2	3	11	5	3	0	0	2	1	6
3	3	5	0	0	0	8	7	0	5	4	2	4	15
4	0	0	0	0	0	0	8	1	2	2	0	4	9
5	3	2	0	1	1	7	10	0	2	0	0	2	4
8	2	0	0	1	0	3	11	3	2	1	4	4	14
9	3	0	0	0	0	3	13	0	4	2	0	4	10
11	2	2	4	2	4	14	15	0	3	4	1	4	12
12	0	0	0	0	0	0	16	0	0	0	0	0	0
15	0	0	0	0	0	0	19	3	0	1	0	0	4
16	0	1	2	0	0	3	21	3	5	4	0	4	16
18	0	0	0	2	0	2	22	0	0	0	0	0	0
19	0	0	0	1	0	1	26	1	2	2	0	2	7
22	0	0	0	0	0	0	27	2	3	4	3	4	16
28	1	2	0	2	4	9	29	2	5	4	3	2	16
29	1	0	0	0	0	1	32	0	3	3	0	2	8
AVERAGES	1.1875	0.75	0.5625	0.6875	0.75	3.9375	AVERAGES	1.3125	2.25	2.1875	1.1875	2.5625	9.5

Note. Problems 1 and 4a are highlighted because these test questions assessed vocabulary. Control group averages are on the left and treatment group averages are on the right.

The average score for an EL in the control group was 3.9/22, while the average score for an EL in the treatment group was 9.5/22. This is a 5.6-point, or 25% difference. This large discrepancy in averages suggests that the ELs in the control group were much less proficient at solving equations than the ELs in the treatment group at the onset of the study as evidenced by the gap in their achievement on the pretest.

Table 13

Pretest Scores per Question for All English Learners Separated by STELs, LTELs, and RFEPs

P.5 STEL Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
4	0	0	0	0	0	0
22	0	0	0	0	0	0
AVERAGES	0	0	0	0	0	0

P. 6 STEL Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
7	0	5	4	2	4	15
16	0	0	0	0	0	0
27	2	3	4	3	4	16
AVERAGES	0.6666667	2.6666667	2.6666667	1.6666667	2.6666667	10.333333

P.5 LTEL Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
1	1	0	0	0	0	1
5	3	2	0	1	1	7
12	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	1	2	0	0	3
19	0	0	0	1	0	1
29	1	0	0	0	0	1
AVERAGES	0.7142857	0.4285714	0.2857143	0.2857143	0.1428571	1.8571429

P.6 LTEL Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
3	3	0	4	4	4	15
10	0	2	0	0	2	4
15	0	3	4	1	4	12
22	0	0	0	0	0	0
32	0	3	3	0	2	8
AVERAGES	0.6	1.6	2.2	1	2.4	7.8

P.5 RFEP Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
2	3	0	3	2	3	11
3	3	5	0	0	0	8
8	2	0	0	1	0	3
9	3	0	0	0	0	3
11	2	2	4	2	4	14
18	0	0	0	2	0	2
28	1	2	0	2	4	9
AVERAGES	2	1.2857143	1	1.2857143	1.5714286	7.1428571

P.6 RFEP Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
5	3	0	0	2	1	6
8	1	2	2	0	4	9
11	3	2	1	4	4	14
13	0	4	2	0	4	10
19	3	0	1	0	0	4
21	3	5	4	0	4	16
26	1	2	2	0	2	7
29	2	5	4	3	2	16
AVERAGES	2	2.5	2	1.125	2.625	10.25

Note. Control group averages are on the left and treatment group averages are on the right. From the top down, Short Term English Learners (STELs), Long Term English Learners (LTELs), and Reclassified English Proficient (RFEPs) data is presented.

The STELs in the control group averaged 0/22 (0%) on the pretest, while STELs in the treatment group averaged 10.3/22 (47%). The STELs in the treatment group (10.3 average) outperformed the English-only students (9.8 average) and the overall class average (9.6 average), indicating that STELs were the highest performing subgroup in the treatment group on the pretest. The LTELs in the treatment group also outperformed the LTELs in the control group by an average of 5.9 points (27%). The LTELs in the control group averaged 1.9 points while the LTELs in the treatment group averaged 7.8 points, also highlighting a pre-existing difference in performance between these two sub-groups at the onset of the study. The gap between EL performances on the pretest narrowed slightly with RFEP students. The RFEPs in the control group averaged 7.1 points compared to the RFEPs in the treatment group averaging 10.3 points.

The ELs within the treatment group, from all three subgroups, averaged higher scores on the pretest compared to the ELs in the control group.

Testing for Normal Distribution and Equal Variance on Pretest. An independent two-samples t-test to compare the groups' mean scores from the pretest cannot be conducted if the data violates the t-test assumptions of normal distribution and equal variance. The tables and figures below present the findings from the normality and variance tests.

Table 14

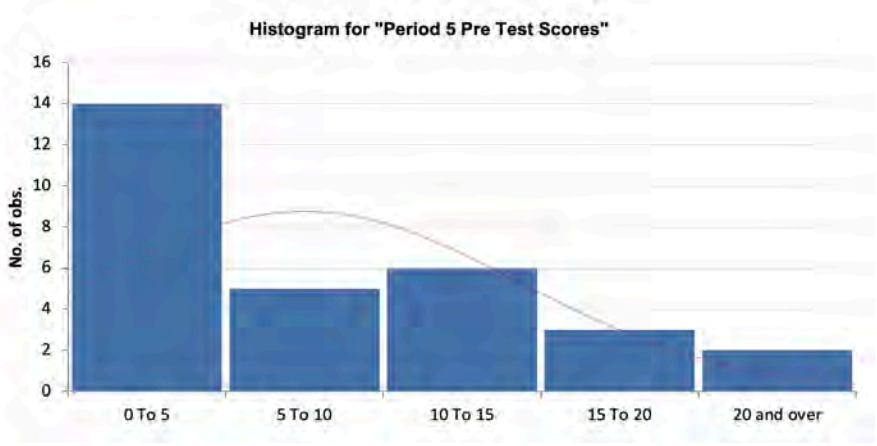
Testing Normality on Control Group Pretest Scores

Variable #1 (Period 5 Pre Test Scores)				
Sample size	30			
Mean	7.50000	*Std Dev*	6.80644	
Median	0.00000			
Skewness	0.53655	*Fisher's Skewness G1*	0.56521	
Kurtosis	2.04283			
Kurtosis Excess (-3)	-0.95717	*Fisher's Kurtosis G2*	-0.90806	
Test		*Test Statistic*	*p-value*	*H0 (5%)*
Shapiro-Wilk W		0.89292	0.00566	Rejected
Shapiro-Francia		0.90621	0.01421	Rejected
Anderson-Darling		1.12980	0.00495	Rejected
Cramer-von Mises		0.18053	0.00873	Rejected
Kolmogorov-Smirnov (Lilliefors)		0.21241	0.00134	Rejected
D'Agostino Skewness		1.35608	0.17507	Cannot reject
D'Agostino Kurtosis		-1.42923	0.15294	Cannot reject
D'Agostino Omnibus		3.88165	0.14359	Cannot reject
Jarque-Bera		2.58465	0.27463	Cannot reject

The Shapiro-Wilks test of normality shows a p-value of .00566, which is <0.05. With a p-value < 0.05, the pretest scores for the control group are not normally distributed. The t-test assumption of normal distribution is violated.

Figure 3

Histogram of Control Group Pretest Scores



The histogram of the control group's pretest scores shows a bell-curve that is skewed left, visually demonstrating abnormal distribution. There is a high frequency of pretest scores between 0-5 compared to the rest of the graph.

Table 15

Testing Normality on Treatment Group Pretest Scores

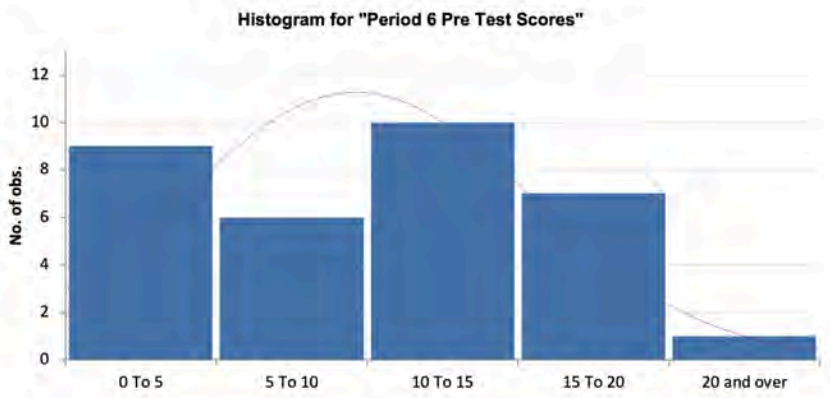
Variable #2 (Period 6 Pre Test Scores)				
Sample size	33			
Mean	9.63636	*Std Dev*	5.83534	
Median	0.00000			
Skewness	-0.20183	*Fisher's Skewness G1*	-0.21157	
Kurtosis	1.90274			
Kurtosis Excess (-3)	-1.09726	*Fisher's Kurtosis G2*	-1.07722	

Test	*Test Statistic*	*p-value*	*H0 (5%)*
Shapiro-Wilk W	0.93574	0.05111	Cannot reject
Shapiro-Francia	0.94583	0.09277	Cannot reject
Anderson-Darling	0.77045	0.04067	Rejected
Cramer-von Mises	0.12408	0.04985	Rejected
Kolmogorov-Smirnov (Lilliefors)	0.14213	0.08864	Cannot reject
D'Agostino Skewness	0.54557	0.58536	Cannot reject
D'Agostino Kurtosis	-2.05011	0.04035	Rejected
D'Agostino Omnibus	4.50061	0.10537	Cannot reject
Jarque-Bera	1.87951	0.39072	Cannot reject

The Shapiro-Wilks test of normality shows a p-value of .05111, which is >0.05. With a p-value > 0.05, the pretest scores for the treatment group qualify as normally distributed.

Figure 4

Histogram of Treatment Group Pretest Scores



The histogram of the treatment group's pretest scores shows a bell-curve that is normally distributed with the maximum nearing the center of the graph, also skewed left slightly. There are much more frequent scores between 10-20 as compared to the control group's pretest scores.

Table 16

Testing Variance on Pretest Scores

F-Test Two-Sample for Variances		
Descriptive Statistics		
	Period 5 Pre Test Scores	**Period 6 Pre Test Scores**
Sample size	30	33
Mean	7.50000	9.63636
Variance	46.32759	34.05114
Standard Deviation	6.80644	5.83534
Mean Standard Error	1.24268	1.01580
Ratio of variances Var[Period 5 Pre Test Scores]/Var[Period 6 Pre Test Scores]		
F	**1.36053**	
F Critical value	1.82325	
F Critical value 2-tailed	2.04962	
p-value 2-tailed (H1: F ≠ 1)	0.39609	H1 Rejected
p-value 1-tailed (H1: F > 1)	0.19805	H1 Rejected
p-value 1-tailed (H1: F < 1)	0.80195	H1 Rejected
F [larger/smaller]		
F	**1.36053**	
F Critical value	1.82325	
F Critical value 2-tailed	2.04962	
H0 F=1 (5%)?	Accepted	

Pretest Independent Two-Samples T-Test. Although there was a violation of a t-test's normal distribution assumption by the control group, an independent two-sample t-test assuming unequal variances and an independent two-sample t-test assuming equal variances was performed on the pretest data.

Table 17

Two-Sample T-Tests on Pretest

t-Test: Two-Sample Assuming Unequal Variances		
	Period 5	**Period 6**
Mean	7.5	9.63636364
Variance	46.3275862	34.0511364
Observations	30	33
Hypothesized Mean Difference	0	
df	57	
t Stat	-1.3310469	
P(T<=t) one-tail	0.09423663	
t Critical one-tail	1.67202889	
P(T<=t) two-tail	0.18847327	
t Critical two-tail	2.00246546	
t-Test: Two-Sample Assuming Equal Variances		
	Period 5 n=30	*Period 6 n=33*
Mean	7.5	9.5625
Variance	46.3275862	34.9637097
Observations	30	32
Pooled Variance	40.45625	
Hypothesized Mean Difference	0	
df	60	
t Stat	-1.2759713	
P(T<=t) one-tail	0.10344157	
t Critical one-tail	1.67064886	
P(T<=t) two-tail	0.20688314	
t Critical two-tail	2.00029782	

The p two-tail value in the independent two-sample t-test assuming unequal variance is 0.188473, which is >.05 and means there is no statistically significant difference between the two groups' scores on the pretest. Similarly, p is greater than 0.05 at .2 in the t-test assuming equal variances, which also signifies that there is no statistically significant difference between groups.

Pretest Mann Whitney U-Test. The independent two-samples t-test reveals there is no statistically significant difference between the means of the two class periods at the onset of the study, however, since the assumption of normal distribution was violated by the pretest data, the researcher also conducted a Mann-Whitney U test to ensure the same statistical conclusion.

Table 18

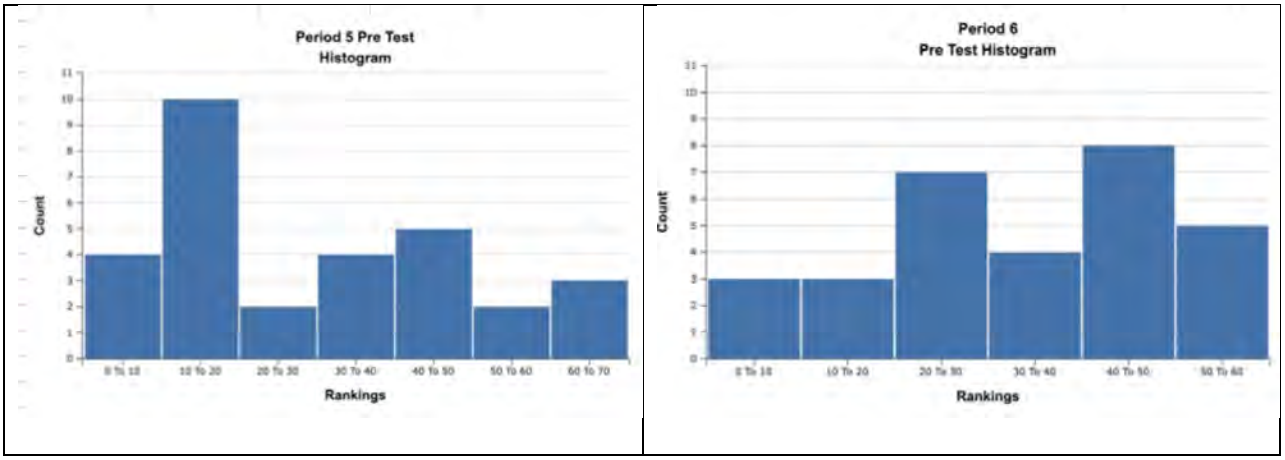
Mann-Whitney U Test on Pretest Data

	Sum of ranks	Count	U-Statistic
Period 5 (control group)	850	30	385
Period 6 (treatment group)	1166	33	605
Critical value	352.08		

The lower of the two u-statistics is 385, and it is greater than the critical value of 352, resulting in a failure to reject the null hypothesis. There is no statistically significant difference between period 5 and period 6 on the pretest, which is the same conclusion reached by the independent two-samples pretest as shown in table 17.

Figure 5

Histogram of Control Group (left) and Treatment Group (right) Pretest Scores



The shapes of the histogram graphs are different. The control group on the left includes a high frequency of rankings between 10-20, while the treatment group on the right shows more evenly distributed rankings, the majority falling between 20-30 and 40-50. Due to the differences in the shapes of the graph, the Mann Whitney U test compares distributions rather than the medians. As noted in table 18, there are no statistically significant differences in the two groups of data, which means there are not statistically significant differences between the distributions of each group.

The absence of statistical significance in the pretest scores implies that the groups are statistically equal in their mathematical abilities in solving equations at the beginning of the research study. If a significant difference in the mean on the posttest were to appear, it may be attributed to the variable under examination in the study.

Posttest

Given the absence of a statistically significant difference between the control and treatment groups at the onset of the study, the researcher began the study by teaching review concepts on how to solve equations and the related vocabulary over the next two weeks, each

group in a different classroom environment. At the end of the two weeks, students were given the same test as the pretest, now as a posttest. The posttest data is used to determine whether there is a statistically significant difference in the means between the groups after learning identical content for two weeks in differing classroom environments.

Overall Performance. Tables 19-23 show many different statistical angles of the control and treatment group's overall performance on the posttest. Total points for each period are presented, as well as the descriptive statistics for each group's scores. There is also a table of how each student performed itemized by each test question with averages at the bottom of each column.

Table 19

Posttest Scores on Solving Equations

Student	Period 5 Posttest Scores	Period 6 Posttest Scores
1	17.00000	20.00000
2	11.00000	19.00000
3	22.00000	18.00000
4	21.00000	22.00000
5	21.00000	19.00000
6	20.00000	21.00000
7	21.00000	20.00000
8	22.00000	18.00000
9	22.00000	22.00000
10	3.00000	22.00000
11	22.00000	18.00000

Student	Period 5 Posttest Scores	Period 6 Posttest Scores
12	21.00000	19.00000
13	21.00000	22.00000
14	22.00000	13.00000
15	9.00000	19.00000
16	19.00000	22.00000
17	17.00000	17.00000
18	19.00000	21.00000
19	21.00000	22.00000
20	22.00000	19.00000
21	22.00000	5.00000
22	16.00000	21.00000
23	22.00000	15.00000
24	14.00000	20.00000
25	21.00000	19.00000
26	12.00000	18.00000
27	5.00000	16.00000
28	22.00000	20.00000
29	12.00000	19.00000
30	8.00000	9.00000
31		17.00000
32		21.00000
33		18.00000

Note. Numbers shown are the total points scored out of 22 total points on the test.

Table 20

Descriptive Statistics on Control Group Posttest

Period 5 Post Test Scores (17.56667±5.64882)					
N	30				
Mean	17.56667	Mean Standard Error	1.03133		
Mean LCL 95%	15.45736	Mean UCL 95%	19.67597		
Trimmed Mean (5%)	18.09259	Geometric Mean	16.14383	Harmonic Mean	13.78497
Median	21.00000	Median Error	0.23599	Mode	22.00000
Standard Deviation	5.64882	Variance	31.90920	Coefficient of Variation	0.32156
Range	19.00000	Minimum	3.00000	Maximum	22.00000
IQR	7.50000	Percentile 25% (Q1)	14.50000	Percentile 75% (Q3)	22.00000
Mean Deviation	4.61556	Median Absolute Deviation	7.00000	Coefficient of Dispersion	0.19206
Sum	527.00000	Sum Standard Error	30.93987		
Total Sum Squares	10,183.00000	Adjusted Sum Squares	925.36667		
Second Moment	30.84556	Third Moment	-205.65274	Fourth Moment	3,072.18066
Fisher's Skewness G1	-1.26458	Skewness	-1.20045	Skewness Standard Error	0.41242
Fisher's Kurtosis G2	0.50242	Kurtosis	3.22895	Kurtosis Standard Error	0.74858

Period 5, the control group, revealed a mean of 17.6/22 on the posttest, which totals 80%. This is a significant improvement compared to the mean of 7.5/22 (34%) scored on the pretest. Average scores on the control group's posttest rose by 46% compared to the pretest scores.

Table 21

Descriptive Statistics on Treatment Group Posttest

Period 6 Post Test Scores (18.51515±3.69223)					
N	33				
Mean	18.51515	Mean Standard Error	0.64274		
Mean LCL 95%	17.20594	Mean UCL 95%	19.82436		
Trimmed Mean (5%)	18.98485	Geometric Mean	17.94913	Harmonic Mean	16.97312
Median	19.00000	Median Error	0.14023	Mode	19.00000
Standard Deviation	3.69223	Variance	13.63258	Coefficient of Variation	0.19942
Range	17.00000	Minimum	5.00000	Maximum	22.00000
IQR	3.00000	Percentile 25% (Q1)	18.00000	Percentile 75% (Q3)	21.00000
Mean Deviation	2.43526	Median Absolute Deviation	2.00000	Coefficient of Dispersion	0.12121
Sum	611.00000	Sum Standard Error	21.21026		
Total Sum Squares	11,749.00000	Adjusted Sum Squares	436.24242		
Second Moment	13.21947	Third Moment	-98.05165	Fourth Moment	1,325.68379
Fisher's Skewness G1	-2.13848	Skewness	-2.04002	Skewness Standard Error	0.39606
Fisher's Kurtosis G2	5.57156	Kurtosis	7.58599	Kurtosis Standard Error	0.72512

Period 6, the treatment group, presents a mean of 18.5/21 (84%) on the posttest, which is a 4% higher average than the control group (80%). This is also a significant improvement compared to the pretest mean scores, which was 43.6%. Average scores in the treatment group rose by 40% compared to the pretest scores.

Table 22

Score Breakdown per Question for Control Group (Period 5) Posttest

P.5 Student	Problem 1 /4	Problem 2 /5	Problem 3 /4	Problem 4a /5	Problem 4b /4	Total Score /22
1	4	2	4	4	3	17
2	3	1	3	0	4	11
3	4	5	4	5	4	22
4	4	4	4	5	4	21
5	4	4	4	5	4	21
6	4	5	4	3	4	20
7	4	4	4	5	4	21
8	4	5	4	5	4	22
9	4	5	4	5	4	22
10	3	0	0	0	0	3
11	4	5	4	5	4	22
12	4	5	3	5	4	21
13	4	4	4	5	4	21
14	4	5	4	5	4	22
15	3	2	0	2	2	9
16	3	4	3	5	4	19
17	4	2	4	3	4	17
18	4	2	4	5	4	19
19	4	4	4	5	4	21
20	4	5	4	5	4	22
21	4	5	4	5	4	22
22	4	1	2	5	4	16
23	4	5	4	5	4	22
24	3	2	0	5	4	14
25	4	5	4	4	4	21
26	3	2	1	2	4	12
27	1	1	0	0	3	5
28	4	5	4	5	4	22
29	4	2	1	2	3	12
30	3	0	4	1	0	8
Average	3.666666667	3.366666667	3.1	3.866666667	3.566666667	17.56666667

Note. Point values based on the rubric provided in figure 2.

Table 23

Score Breakdown per Question for Treatment Group (Period 6) Posttest

P.6 Student	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
1	4	4	4	4	4	20
2	4	2	4	5	4	19
3	4	1	4	5	4	18
4	4	5	4	5	4	22
5	4	5	1	5	4	19
6	4	4	4	5	4	21
7	4	5	4	3	4	20
8	4	4	4	2	4	18
9	4	5	4	5	4	22
10	4	5	4	5	4	22
11	4	2	3	5	4	18
12	4	5	3	4	3	19
13	4	5	4	5	4	22
14	4	1	1	4	3	13
15	4	4	2	5	4	19
16	4	5	4	5	4	22
17	4	4	4	1	4	17
18	4	4	4	5	4	21
19	4	5	4	5	4	22
20	4	2	4	5	4	19
21	3	1	0	1	0	5
22	4	4	4	5	4	21
23	4	2	4	1	4	15
24	4	5	4	3	4	20
25	4	5	1	5	4	19
26	4	2	4	5	3	18
27	3	4	4	1	4	16
28	4	4	4	5	3	20
29	4	4	4	3	4	19
30	4	1	4	0	0	9
31	4	4	2	5	2	17
32	4	4	4	5	4	21
33	4	3	4	3	4	18
Average	3.9393939	3.6363636	3.4242424	3.9393939	3.5757576	18.515152

Comparing table 22 and table 23 reveals slightly higher averages from the treatment group over the control group on every question on the posttest.

Performance of English-Only Students. Table 24 displays the averages of how the English-only students in the control (p.5, left) and treatment (p. 6, right) groups performed on the posttest compared to how the ELs scored on the test (table 25).

Table 24

Posttest Scores per Question for English-Only Students

P.5 EO Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
3	4	5	4	5	4	22
5	4	4	4	5	4	21
7	4	4	4	5	4	21
11	4	5	4	5	4	22
12	4	5	3	5	4	21
13	4	4	4	5	4	21
16	3	4	3	5	4	19
18	4	2	4	5	4	19
19	4	4	4	5	4	21
23	4	5	4	5	4	22
26	3	2	1	2	4	12
27	1	1	0	0	3	5
28	4	5	4	5	4	22
30	3	0	4	1	0	8
Averages	3.57142857	3.57142857	3.35714286	4.14285714	3.64285714	18.2857143

P.6 EO Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
1	4	4	4	4	4	20
2	4	2	4	5	4	19
3	4	1	4	5	4	18
4	4	5	4	5	4	22
6	4	4	4	5	4	21
10	4	5	4	5	4	22
11	4	2	3	5	4	18
12	4	5	3	4	3	19
13	4	5	4	5	4	22
14	4	1	1	4	3	13
15	4	4	2	5	4	19
16	4	5	4	5	4	22
20	4	2	4	5	4	19
23	4	2	4	1	4	15
28	4	4	4	5	3	20
31	4	4	2	5	2	17
32	4	4	4	5	4	21
Averages	4	3.47058824	3.47058824	4.58823529	3.70588235	19.2352941

English-only students in the treatment group scored an average of 1 point higher than English-only students in the control group, which is a turnaround from performance on the pretest where English-only students from the control group scored higher than English-only students in the treatment group by an average of 1.8 points. In both groups, English-only students outperformed the English learners by an average of 1.3 points (6%) in the control group and 1.45 points (6.6%) in the treatment group (see EL averages in the table below).

Performance of English Learners. Table 25 displays the averages of how the English learners in the control (p.5, left) and treatment (p. 6, right) groups performed on the posttest compared to how the English-only students scored on the test (table 24).

Table 25

Posttest Scores per Question for All English Learners Combined (STELs, LTELs, and RFEPs)

P.5 Student	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22	P.6 Student	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
1	4	2	4	4	3	17	5	4	5	1	5	4	19
2	3	1	3	0	4	11	7	4	5	4	3	4	20
4	4	4	4	5	4	21	8	4	4	4	2	4	18
6	4	5	4	3	4	20	9	4	5	4	5	4	22
8	4	5	4	5	4	22	17	4	4	4	1	4	17
9	4	5	4	5	4	22	18	4	4	4	5	4	21
10	3	0	0	0	0	3	19	4	5	4	5	4	22
14	4	5	4	5	4	22	21	3	1	0	1	0	5
15	3	2	0	2	2	9	22	4	4	4	5	4	21
17	4	2	4	3	4	17	24	4	5	4	3	4	20
20	4	5	4	5	4	22	25	4	5	1	5	4	19
21	4	5	4	5	4	22	26	4	2	4	5	3	18
22	4	1	2	5	4	16	27	3	4	4	1	4	16
24	3	2	0	5	4	14	29	4	4	4	3	4	19
25	4	5	4	4	4	21	30	4	1	4	0	0	9
29	4	2	1	2	3	12	33	4	3	4	3	4	18
Averages	3.75	3.1875	2.875	3.625	3.5	16.9375	Averages	3.875	3.8125	3.375	3.25	3.4375	17.75

Note. Problems 1 and 4a are highlighted because these test questions assessed vocabulary acquisition.

There are little to no notable differences between the group averages on problems 1 and 4a. Control group averages are on the left and treatment group averages are on the right. The average scores among ELs in the treatment group (period 6) are slightly higher than the scores of ELs in the control group (period 5).

The average scores among STELs and RFEPs in the control group (period 5) are slightly higher than the scores of STELs and RFEPs in the treatment group (period 6), which is a notable turnaround from the pretest scores when the treatment group STELs scored an average of 10.3 points (46.8%) higher and treatment group RFEPs scored an average of 3.2 (14.5%) points higher than the control group. The average scores of LTELs in the treatment group are 15% higher than average scores of LTELs in the control group. In order to compare the means between the control and treatment groups using an independent two-samples t-test and test for statistical significance on the posttest, the data must be checked for normal distribution and equal variance.

Table 26

Posttest Scores per Question for All English Learners Separated by STELs, LTELs, and RFEPs

P.5 STEL Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
17	4	2	4	3	4	17
25	4	5	4	4	4	21
Averages	4	3.5	4	3.5	4	19

P. 6 STEL Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
18	4	4	4	5	4	21
19	4	5	4	5	4	22
30	4	1	4	0	0	9
Averages	4	3.3333333	4	3.3333333	2.6666667	17.333333

P.5 LTEL Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
1	4	2	4	4	3	17
2	3	1	3	0	4	11
6	4	5	4	3	4	20
10	3	0	0	0	0	3
15	3	2	0	2	2	9
24	3	2	0	5	4	14
29	4	2	1	2	3	12
Averages	3.4285714	2	1.7142857	2.2857143	2.8571429	12.285714

P.6 LTEL Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
21	3	1	0	1	0	5
24	4	5	4	3	4	20
27	3	4	4	1	4	16
29	4	4	4	3	4	19
33	4	3	4	3	4	18
Averages	3.6	3.4	3.2	2.2	3.2	15.6

P.5 RFEP Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
4	4	4	4	5	4	21
8	4	5	4	5	4	22
9	4	5	4	5	4	22
14	4	5	4	5	4	22
20	4	5	4	5	4	22
21	4	5	4	5	4	22
22	4	1	2	5	4	16
Averages	4	4.2857143	3.7142857	5	4	21

P.6 RFEP Student #	Problem 1	Problem 2	Problem 3	Problem 4a	Problem 4b	Total Score /22
5	4	5	1	5	4	19
7	4	5	4	3	4	20
8	4	4	4	2	4	18
9	4	5	4	5	4	22
17	4	4	4	1	4	17
22	4	4	4	5	4	21
25	4	5	1	5	4	19
26	4	2	4	5	3	18
Averages	4	4.25	3.25	3.875	3.875	19.25

Note. Control group averages are on the left and treatment group averages are on the right. From the top down, Short Term English Learners (STELs), Long Term English Learners (LTELs), and Reclassified English Proficient (RFEP) data is presented.

Testing for Normal Distribution and Equal Variance on the Posttest. In order to conduct an independent two-samples t-test on the posttest data to compare the means, assumptions of normal distribution and equal variance must be met. Tables 27-29 show the outcomes of the normality and variance tests, revealing the need to conduct a Mann-Whitney U test due to the violation of normality and equal variance.

Table 27

Testing Normality on Control Group Posttest Scores

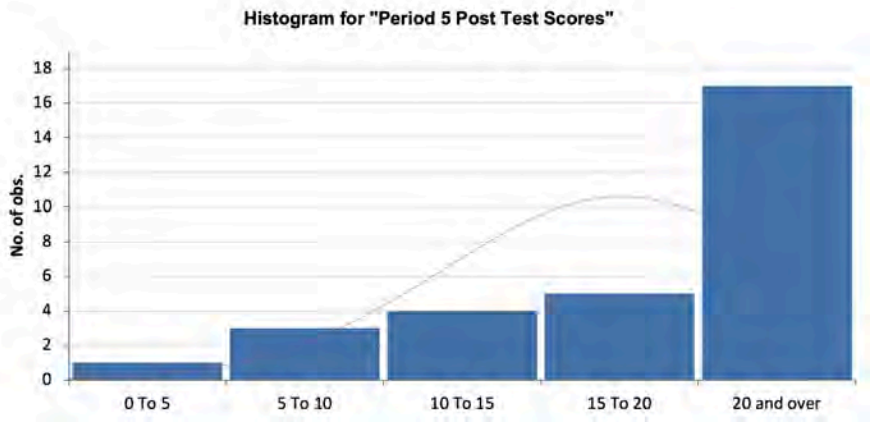
Normality Tests			
Variable #1 (Period 5 Post Test Scores)			
Sample size	30		
Mean	17.56667	*Std Dev*	5.64882
Median	0.00000		
Skewness	-1.20045	*Fisher's Skewness G1*	-1.26458
Kurtosis	3.22895		
Kurtosis Excess (-3)	0.22895	*Fisher's Kurtosis G2*	0.50242

Test	*Test Statistic*	*p-value*	*H0 (5%)*
Shapiro-Wilk W	0.78425	0.00003	Rejected
Shapiro-Francia	0.79088	0.00013	Rejected
Anderson-Darling	2.56799	1.19110E-6	Rejected
Cramer-von Mises	0.46913	4.54380E-6	Rejected
Kolmogorov-Smirnov (Lilliefors)	0.26167	0.00001	Rejected
D'Agostino Skewness	2.73066	0.00632	Rejected
D'Agostino Kurtosis	0.80471	0.42099	Cannot reject
D'Agostino Omnibus	8.10405	0.01739	Rejected
Jarque-Bera	7.27098	0.02637	Rejected

The Shapiro-Wilks test of normality shows a p-value of 0.00003, which is <0.05. With a p-value <0.05, the posttest scores for the control group are not normally distributed and violate the t-test assumption of normal distribution.

Figure 6

Histogram of Control Group Posttest Scores



The histogram of the control group's posttest scores shows a bell-curve skewed right, visually demonstrating abnormal distribution. There is a high frequency of pretest scores 20 and over compared to the rest of the scores on the graph.

Table 28

Testing Normality on Treatment Group Posttest Scores

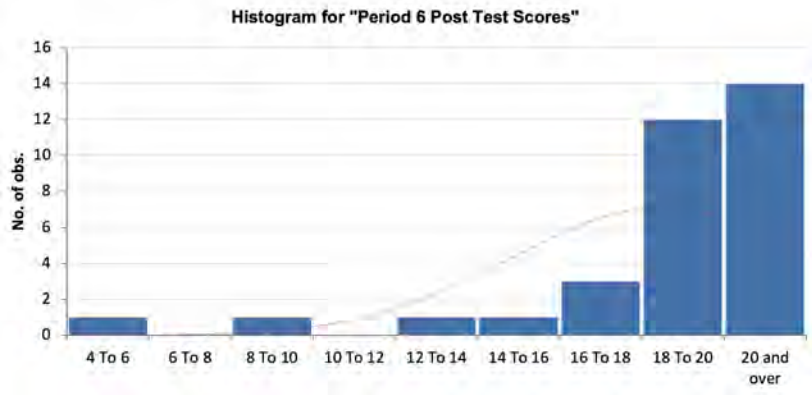
Variable #2 (Period 6 Post Test Scores)			
Sample size	33		
Mean	18.51515	*Std Dev*	3.69223
Median	0.00000		
Skewness	-2.04002	*Fisher's Skewness G1*	-2.13848
Kurtosis	7.58599		
Kurtosis Excess (-3)	4.58599	*Fisher's Kurtosis G2*	5.57156

Test	*Test Statistic*	*p-value*	*H0 (5%)*
Shapiro-Wilk W	0.77796	0.00001	Rejected
Shapiro-Francia	0.76841	0.00003	Rejected
Anderson-Darling	2.08723	0.00002	Rejected
Cramer-von Mises	0.34446	0.00009	Rejected
Kolmogorov-Smirnov (Lilliefors)	0.23240	0.00009	Rejected
D'Agostino Skewness	4.10348	0.00004	Rejected
D'Agostino Kurtosis	3.28532	0.00102	Rejected
D'Agostino Omnibus	27.63181	9.99605E-7	Rejected
Jarque-Bera	51.80719	5.62615E-12	Rejected

The Shapiro-Wilks test of normality shows a p-value of 0.00001, which is <0.05. With a p-value <0.05, the posttest scores for the treatment group are not normally distributed and violate the t-test assumption of normal distribution.

Figure 7

Histogram of Treatment Group Posttest Scores



The histogram of the treatment group's posttest scores shows a bell-curve skewed right, visually demonstrating abnormal distribution. There is a high frequency of pretest scores 18 and over compared to the rest of the scores on the graph.

Table 29

Testing Variance on Posttest Scores

F-Test Two-Sample for Variances

Descriptive Statistics

	Period 5 Post Test Scores	Period 6 Post Test Scores
Sample size	30	33
Mean	17.56667	18.51515
Variance	31.90920	13.63258
Standard Deviation	5.64882	3.69223
Mean Standard Error	1.03133	0.64274

Ratio of variances Var[Period 5 Post Test Scores]/Var[Period 6 Post Test Scores]

F	**2.34066**	
F Critical value	1.82325	
F Critical value 2-tailed	2.04962	
p-value 2-tailed (H1: F ≠ 1)	0.02065	H1 Accepted
p-value 1-tailed (H1: F > 1)	0.01032	H1 Accepted
p-value 1-tailed (H1: F < 1)	0.98968	H1 Rejected

F [larger/smaller]

F	**2.34066**	
F Critical value	1.82325	
F Critical value 2-tailed	2.04962	
H0 F=1 (5%)?	Rejected	

Note. The highlighted row shows the p-value for a two-sample F-test for variance.

The p-value 2-tailed is .02065, which is <0.05. A p-value <0.05 means the variances are not equal on the posttest.

Posttest Independent Two-Samples T-Test. Despite the violation of the normality and equal variance assumptions an independent two-samples t-test was conducted on the posttest data assuming unequal variances and the results of the test are presented in table 30. The t-test reveals no statistically significant differences between the posttest scores of the control and treatment groups with a p-value > 0.05.

Table 30

Two-Sample T-Test Assuming Unequal Variances on Posttest

t-Test: Two-Sample Assuming Unequal Variances		
	Period 5	**Period 6**
Mean	17.56667	18.51515
Variance	31.9092	13.63258
Observations	30	33
Hypothesized Mean Difference	0	
df	49	
t Stat	-0.78051	
P(T<=t) one-tail	0.219423	
t Critical one-tail	1.676551	
P(T<=t) two-tail	0.438846	
t Critical two-tail	2.009575	

The p two-tail value is 0.438846, in which p > .05, meaning there is no statistically significant difference between the two groups' scores on the posttest.

Posttest Mann Whitney U Test. Since the pre- and posttest data violate the independent two-samples t-test assumptions of normal distribution and equal variances, a Mann-Whitney U test was also used to compare the means on the pre and posttest data.

Table 31

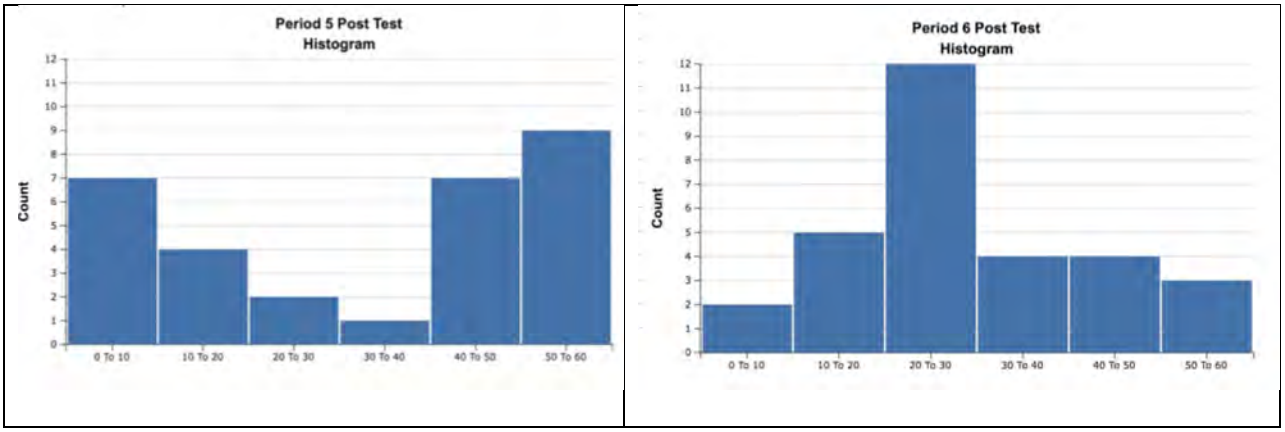
Posttest Mann-Whitney U Test

	Sum of Ranks	**Count**	**U Statistic**
Period 5 (control group)	990.5	30	525.5
Period 6 (treatment group)	1025.5	33	464.5
Critical Value	352.08		

The lower of the two u-statistics is 464, and this value is greater than the critical value of 352, resulting in failure to reject the null hypothesis. This echoes the independent two-samples t-test findings where no statistically significant difference was found between the means of period 5 (control group) and 6 (treatment group).

Figure 8

Histogram of Control Group (left) and Treatment Group (right) Posttest Scores



The shapes of the histogram graphs are different. The control group on the left includes a high frequency of rankings between 0-10, 40-50, and 50-60, while the treatment group on the right shows most rankings falling between 20-30. The differences in the shapes of the graph mean that the Mann Whitney U Test compares distributions rather than the medians. As noted in table 31, there are no statistically significant differences in the two groups of data, which means there are not statistically significant differences between the distributions of each group.

Perceptions of Teacher Leadership: Multifactor Leadership Questionnaire (MLQ)

This study also analyzes students' perceptions of the teacher as a leader through the Multifactor Leadership Questionnaire (MLQ). The MLQ is a 45-question survey that students completed on their laptops after clicking a link that was sent to their emails (see Appendix A for instructions and format). Students read a leadership characteristic or behavior and rated the teacher as doing the behavior 0 (not at all), 1 (once in a while), 2 (sometimes), 3 (fairly often), or

4 (frequently, if not always). There was also an option to click “unsure” which had no point value associated with it. A Mann-Whitney U test was used to compare the mean scores of the groups.

Table 32

MLQ Average Score per Question

	Control Group Period 5 Average Score	**Treatment Group Period 6 Average Score**
MLQ Question	0- not at all 1- once in a while 2- sometimes 3- fairly often 4- frequently, if not always	
1. Provides assistance in exchange for your efforts.	3.48	3.52
2. Re-examines critical assumptions to question whether they are appropriate.	2.76	3.04
3. Fails to interfere until problems become serious.	1.15	0.52
4. Focuses attention on irregularities, mistakes, exceptions, and deviations from standards.	2.3	2.26
5. Avoids getting involved when important issues arise.	0.5	0.54
6. Talks about his/her most important values and beliefs.	2.19	2.26
7. Is absent when needed.	0.35	0.35
8. Seeks differing perspectives when solving problems.	2.8	3.23
9. Talks optimistically about the future.	2.57	2.65
10. Instills pride in others for being associated with him/her.	2.43	2.67
11. Discusses in specific terms who is responsible for achieving performance targets.	2.68	2.59
12. Waits for things to go wrong before taking action.	0.21	0.19
13. Talks enthusiastically about what needs to be accomplished.	3.18	3.13
14. Specifies the importance of having a strong sense of purpose.	2.75	2.93
15. Spends time teaching and coaching.	3.5	3.2

MLQ Question	Control Group Period 5 Average Score	Treatment Group Period 6 Average Score
16. Makes clear what you can expect to receive when performance goals are achieved.	3.44	3.36
17. Shows that he/she is a firm believer in "If it ain't broke, don't fix it."	1.64	1.7
18. Goes beyond self-interest for the good of the group.	2.9	2.95
19. Treats others as individuals rather than just as members of the group.	2.95	2.83
20. Demonstrates that problems must become chronic before taking action.	1.32	1.06
21. Acts in ways that build my respect.	3.64	3.34
22. Concentrates his/her full attention on dealing with mistakes, complaints, and failures.	2.58	2.89
23. Considers the moral and ethical consequences of decisions.	2.79	3.17
24. Keeps track of all mistakes.	2.29	2.39
25. Displays a sense of power and confidence.	3.37	3.19
26. Articulates a compelling vision of the future.	2.9	2.92
27. Directs my attention toward failures to meet standards.	2	2.04
28. Avoids making decisions.	0.48	0.08
29. Considers that I have different needs, abilities, and aspirations from others.	2.83	3.04
30. Gets me to look at problems from many different angles.	2.81	2.97
31. Helps me to develop my strengths.	3.32	2.78
32. Suggests new ways of looking at how to complete assignments.	2.96	2.93
33. Delays responding to urgent questions.	0.45	0.54
34. Emphasizes the importance of having a collective sense of mission.	2.65	3
35. Expresses satisfaction when I meet expectations.	3.10	3.26
36. Expresses confidence that goals will be achieved.	3.54	3.23
37. Is effective in meeting my job-related needs.	3.10	3
38. Uses methods of leadership that are satisfying.	3.41	3.19
39. Gets you to do more than you expected to do.	2	2.48
40. Is effective in representing my group to higher authority.	3	2.9
41. Works with me in a satisfactory way.	3.29	3.21
42. Heightens my desire to succeed.	3.16	3

MLQ Question	Control Group Period 5 Average Score	Treatment Group Period 6 Average Score
43. Is effective in meeting organizational requirements.	3.09	3.14
44. Increases my willingness to try harder.	3.18	3.09
45. Leads a group that is effective.	3.46	3.32

Note. The highlighted rows show the 7 questions that have an average difference of ±0.35 or more. The 0.35 cutoff value was chosen to produce the top 7 question items to compare with the largest differences in rating. It was also chosen to limit the number of comparisons for the scope of this paper. The left column shows each of the 45 MLQ questions that the 61 students responded to while ranking their teacher on a frequency scale from 0-4, 0 representing not at all to 4 representing frequently, if not always.

Table 33

MLQ Mann-Whitney U Test Total Scores with Rankings

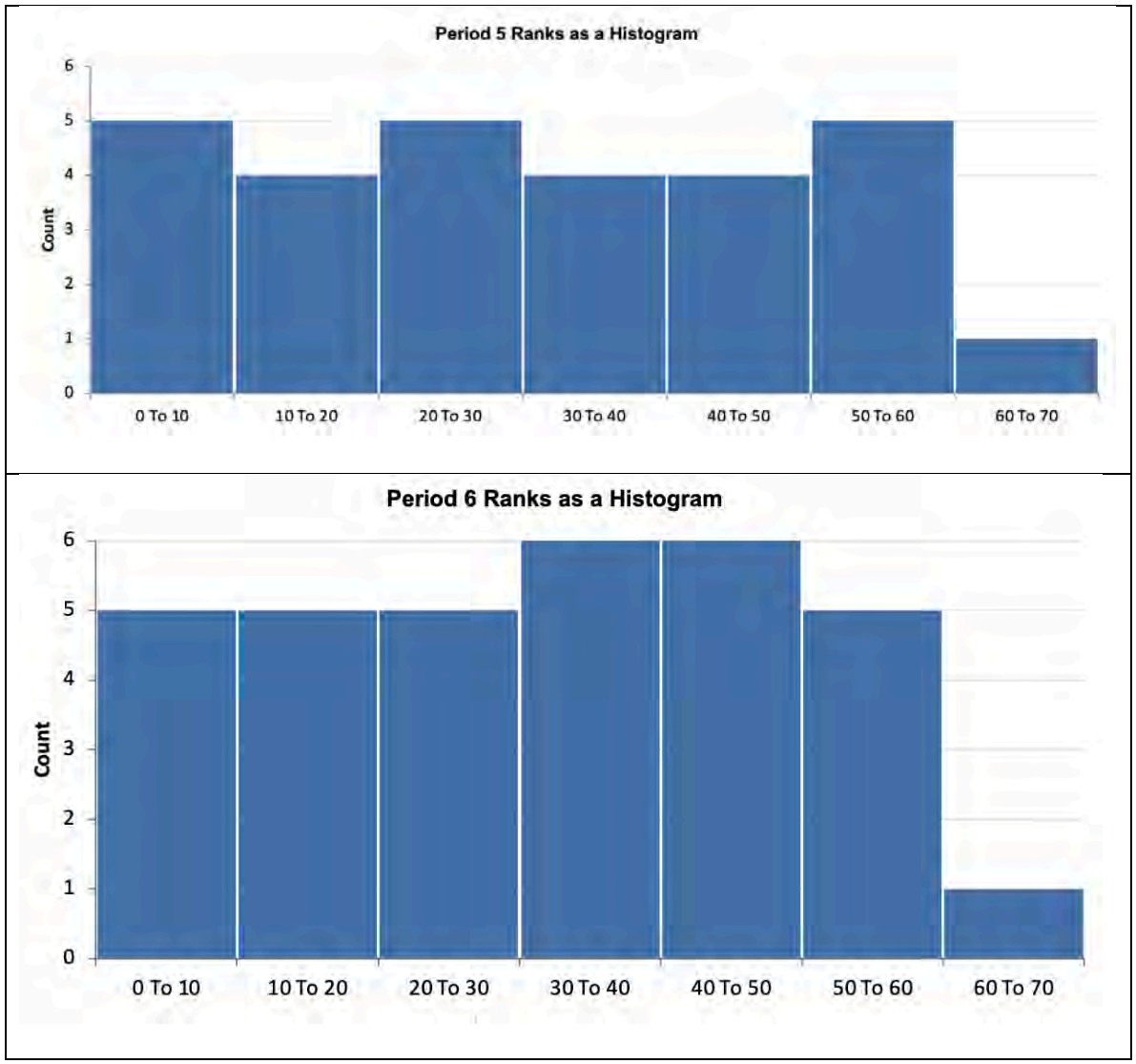
Treatment	MLQ Total Score	Rank
Period 6	30	1
Period 6	42	2
Period 6	46	3
Period 5	56	4
Period 5	57	5
Period 5	60	6
Period 5	61	7.5
Period 5	61	7.5
Period 6	64	9.5
Period 6	64	9.5
Period 6	65	11.5
Period 6	65	11.5
Period 6	66	13
Period 6	69	14.5
Period 6	69	14.5
Period 5	70	16
Period 5	72	17.5
Period 5	72	17.5

Treatment	MLQ Total Score	Rank
Period 5	74	19
Period 5	79	20.5
Period 6	79	20.5
Period 5	80	22
Period 5	82	23.5
Period 6	82	23.5
Period 5	83	25
Period 6	85	26
Period 5	87	27.5
Period 6	87	27.5
Period 6	89	29
Period 6	90	30.5
Period 6	90	30.5
Period 5	92	32.5
Period 6	92	32.5
Period 5	93	34.5
Period 6	93	34.5
Period 5	96	37
Period 6	96	37
Period 6	96	37
Period 5	98	39
Period 6	100	40
Period 6	101	41.5
Period 6	101	41.5
Period 5	106	43.5
Period 6	106	43.5
Period 5	108	45
Period 6	113	46
Period 5	114	47.5
Period 6	114	47.5
Period 5	115	49
Period 6	116	50
Period 5	123	51
Period 6	124	52
Period 5	125	53
Period 5	126	54
Period 5	127	55
Period 5	128	56

Treatment	MLQ Total Score	Rank
Period 6	133	57
Period 6	134	58
Period 6	138	59
Period 6	147	60
Period 5	156	61

Figure 9

Histogram of Control Group (top) and Treatment Group (bottom) MLQ Scores



The shapes of the histograms for the rankings of each group are similar enough to where the Mann Whitney U Test compares the medians of the two groups rather than the distributions.

Table 34

MLQ Mann-Whitney U Test Results

	Sum of Ranks	Count	U Statistic
Period 5 (control group)	876.5	28	470.5
Period 6 (treatment group)	1014.5	33	453.5
Critical Value	326.075488		

The lower of the two u-statistics is 453.5, and this value is greater than the critical value of 326, resulting in failure to reject the null hypothesis. There is not a statistically significant difference between the medians of period 5 (control group) and period 6 (treatment group) MLQ scores.

Presentation of Results

Statistical Significance

Statistical significance for the posttest is presented in an independent two-samples t-test (table 30) and a Mann-Whitney U test (table 31), both revealing no statistical significance exists between the posttest scores of the control and treatment groups and a failure to reject the null hypotheses. Since the pre- and posttest data violated normality and equal variance assumptions needed to conduct a t-test, the researcher did both an independent two-samples t-test assuming unequal variances and a Mann-Whitney U test since a Mann-Whitney U test is a nonparametric, distribution-free test. The independent two-sample t-test ($p > 0.05$) and the Mann-Whitney U test findings indicate that there was no statistical significance between the control and treatment groups' test scores before or after the treatment. The classroom environment appears to have no statistically significant effect on students' test scores on solving equations in this study.

Multifactor Leadership Questionnaire data is presented as averaged scores to each of the 45 questions (table 32) and as total scores per student ranked in ascending order (table 33). The Mann-Whitney U test results are presented in table 34. The findings show there are no statistically significant differences between the responses from period 5 (control group) and period 6 (treatment group), implying that the classroom environment has no effect on the way students perceive the teacher as a leader. Students in the control group rated the teacher's leadership similarly overall to how the treatment group rated the teacher's leadership.

There is a failure to reject the null hypothesis for hypotheses 1 and 2. Based on the quantitative data from this study and the lack of statistically significant results, there appears not to be significantly higher assessment averages among the secondary mathematics students, including English-only students and English learners, in an organized and well-designed classroom environment compared to students in an unorganized and non-designed classroom environment. There also does not appear to be higher perception ratings of a teacher's leadership in the presence of an organized and well-designed classroom than in the presence of an unorganized and non-designed classroom.

Practical Significance

Academic Improvement

While there may not be statistically significant findings from the data in this study, there are many notable results. The average score on the pretest for solving equations when combining both groups was 8.6/22 (39%) but after the intervention, both groups averaged 18/22 (82%) for an overall improvement of 43%. In addition, there was a 2.1-point difference in the average scores between groups on the pretest (control group 7.5 and treatment group 9.6), with the treatment group scoring higher than the control group, but this gap lessened to an average

difference of 0.9-point difference on the posttest (control group 17.6 and treatment group 18.5), where the treatment group scored only slightly higher than the control group. The comparison of the pre and posttest averages illuminates how the control group's average rose more than the treatment group's average from the pretest to the posttest. The STELs and RFEPs from the control group also experienced particularly large improvement when comparing the pre- and posttests. The STELs in the control group went from averaging 0 points on the pretest to an average of 19 points on the posttest, while the RFEPs went from an average of 7.1 points on the pretest to an average of 21 points on the posttest.

Incomplete Surveys

Data from the Multifactor Leadership Questionnaire reveal 93% of students submitted incomplete surveys in the control group and 94% of students submitted incomplete surveys in the treatment group. Students from the control group left an average of 9 questions blank out of a 45-question survey, while students from the treatment group left an average of 10 questions blank per survey.

MLQ Differences Between Groups

Despite no statistically significant differences in the MLQ results, there are differences in the average scores to individual questions between the control and treatment groups (table 32). The frequency scale used on the MLQ includes the following values: 0, not at all, 1, once in a while, 2, sometimes, 3, fairly often, and 4, frequently, if not always. The control group ranked the teacher with a 2.8 frequency compared to 3.23 from the treatment group to the statement, "Seeks differing perspectives when solving problems" (MLQ item 8). The treatment group perceived the teacher to include differing perspectives when solving problems more frequently than the control group. A similar difference between groups exists towards the statement,

"Considers the moral and ethical consequences of decisions" (MLQ item 23). The treatment group demonstrated a higher rating than the control group, meaning the treatment group perceives the teacher to consider the moral and ethical consequences of decisions more frequently than the control group.

A few more differences in the MLQ results emerged. The control group perceived the teacher to, "Help me to develop my strengths" better than the treatment group (MLQ item 31), rating the teacher with a 3.32 frequency compared to a 2.78, a difference of 0.54. The control group also perceived the teacher to avoid making decisions (MLQ item 28) more frequently than the treatment group with a score difference of 0.4. The treatment group perceived the teacher to emphasize the importance of having a collective sense of mission more frequently than the control group, rating the teacher with a 3 compared to a 2.65 (MLQ item 34). The treatment group also perceived the teacher to do a better job in getting them to do more than they expected to do (MLQ item 39) compared to the control group, rating a 2.48 compared to 2. The highest difference between the control and treatment groups was 0.63 where the control group rated the teacher as more likely to fail to interfere until problems become serious (MLQ item 3) compared to the treatment group.

Summary

The quantitative results of this study reveal statistically insignificant results regarding the classroom environment's effect on students' academic achievement and perceptions of the teacher as a leader. There is no statistically significant difference detected between the two groups. The students who attended class in an unorganized and undecorated classroom environment (control group) scored the teacher as a similar leader overall and averaged similarly on an exam compared to the students who attended class in an organized and well-decorated

classroom environment (treatment group). The reasons for the lack of statistical significance are discussed in the next chapter, as well as a discussion of many individual statistical results that suggest practical significance and implications.

CHAPTER 5: CONCLUSIONS AND DISCUSSION

Chapter 5 includes a discussion of the statistical results and relevant conclusions from the pretest, posttest, and MLQ data. The results of the study are applied to the original problem statement and current leadership issues. The chapter closes with recommendations for action that include professional development, classroom design coaches, and funding of classroom materials and includes many recommendations for future research that will enhance, clarify, and strengthen the findings from this paper. Much work remains to bridge the gap in literature on the impact that classroom design has on secondary public school students. Despite the data from this research study failing to yield statistically significant results, other research studies suggest educational leaders should develop appropriate expectations for all secondary educators to establish a classroom environment that maximizes language acquisition (Alshaiji & Alsaleem, 2014; Kieff, 2003; Vintinner et al., 2015), promotes academic achievement (Asiyai, 2014; Kephart & Floyd, 1954) and elicits favorable perceptions (Astuti, 2013; Chi & Chi, 2014).

Discussion of Findings/Results and Conclusions

The results of this study may have been statistically significant if there was a larger sample size, if the study took place over a longer period of time, if the teacher utilized the design of the treatment classroom better, and if all students completed the MLQ survey in full. The quantitative study in this paper included n=63 participants for the equations test and n=61 participants for the MLQ survey, and took place over the course of three weeks. Sixty-three participants is a small sample size for a quantitative study and may be one reason the data did not yield statistically significant outcomes.

Variables Affecting Results

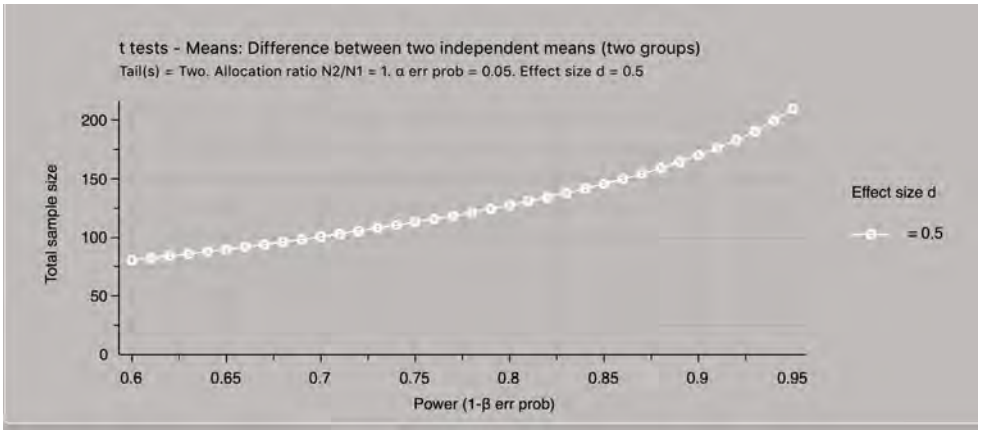
Sample Size

There were sample size constraints and time constraints due to the ethical implications of prolonging students' exposure in a poor classroom environment and because the researcher was using a colleague's classroom to host the control group, resulting in the displacement of a teacher during her prep period. The school did not have any unused classroom environments that the researcher could use to host the control group, limiting the teacher to one control group and one treatment group as opposed to the possibility of having two control groups and two treatment groups if there was access to an empty classroom to host another control group at a different time of day. This could have doubled the sample size of the study.

According to a G*Power analysis, n=128 with n=64 in each subgroup would have been the minimum required sample size to yield statistically significant results for an independent two-samples t-test comparing the difference between two independent means.

Figure 10

*Independent Two-Samples T-Test G*Power X-Y Plot*

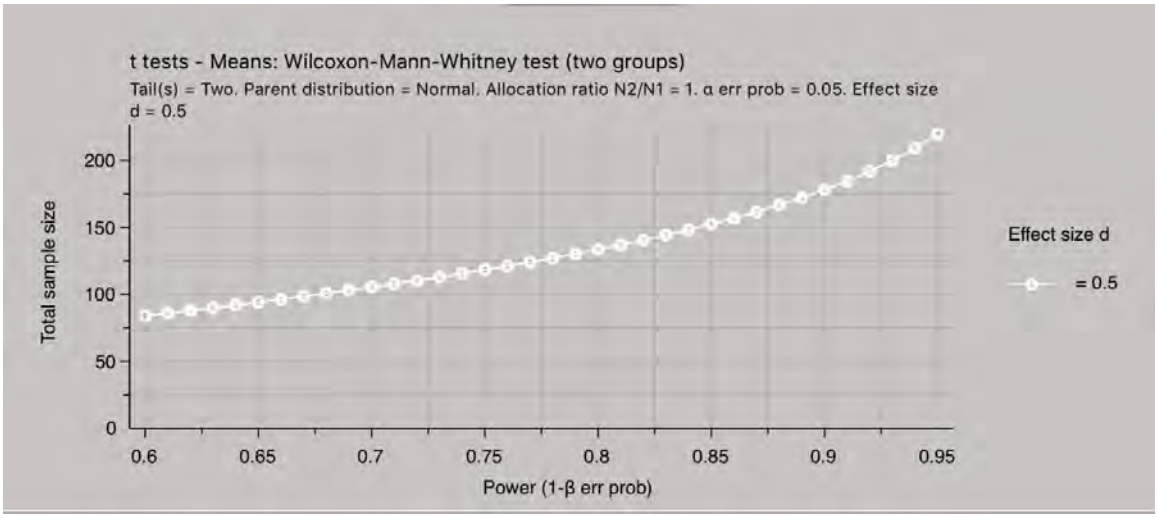


Note: Parameters for this graph include effect size d=0.5, allocation ratio N2/N1=1, two-tailed, and a type 1 error rate of 0.05.

A separate G*Power analysis shows n=134 with n=67 in each subgroup would have been the minimum required sample size to yield statistically significant results for a Mann-Whitney U test that compares the means of two groups.

Figure 11

*Mann-Whitney U Test G*Power X-Y Plot*



The sample size in this research study (n=63) was much less than the G*Power suggested sample size of 134 participants, and is likely a contributing factor as to why neither the independent two-samples t-test, nor the Mann-Whitney U test produced statistically significant results on the posttest or the MLQ.

Length of Research

The acute nature of the study was an ethical consideration for control group students who should not have to learn core mathematical content in an inferior classroom

than the treatment group. The study was only three weeks long because this is the time needed to introduce students to the course and review how to solve equations. The course curriculum did not start until after the administration of the test on equations and the test did not count against students' grades. This exemption from grading could not continue all school year. The space used to host the control group was also not a free space, so the acute nature of the study also was respectful of the borrowed space the researcher asked to use from a colleague.

Utilization of the Design of the Treatment Classroom

In the interest of teaching the control and treatment classes in exactly the same manner, the teacher did not utilize strategic design components in the treatment classroom such as the incentive system, incorporation of the class theme, active involvement of the word wall into instruction, or the integration of posters from the "Key Concepts" wall. Without incorporating the design of the treatment classroom into instruction, the results of this research suggests the mere presence of classroom design and organization may not have any effect on students' perceptions of their teacher or their academic achievement. The results of the study may have been different if the teacher interacted with the design of the classroom environment during instruction.

Diction on the MLQ and English Fluency

The Multifactor Leadership Questionnaire (MLQ) was left significantly incomplete by over 90% of students in both the control and treatment groups, likely leading to invalid results. Out of a 45-question survey, each student from the control group left an average of 9 questions blank, while students from the treatment group left an average of 10 questions blank. In period 5, the control group (n=28), 14 students left

question 10 blank, 17 students left question 17 blank, and 12 students left question 40 blank. Only two students out of 28 in the control group completed the entire MLQ. In period 6, the treatment group (n=33), 15 students left question 10 blank, 23 students left question 17 blank, 17 left question 20 blank, and 12 left question 40 blank. Only two students in the entire treatment group fully completed the MLQ.

The lack of completion is likely due to the high volume of English learners in each group (50% ELs in the control group and 48% ELs in the treatment group) and the diction, syntax, and particular English phrases used on the survey. Question 10, where a total of 29 of 61 participants left it blank, reads, “Instills pride in others for being associated with him/her.” Students may not know what the word “instill” means or the word “associated” leading many to leave it blank. Question 17 illustrates the disconnection between the diction on the survey and students’ English literacy because 40 of 61 participants left it blank. Question 17 reads, “Shows that he/she is a firm believer in ‘if it ain’t broke don’t fix it’" This English phrase not only uses slang like “ain’t”, it also assumes the participants understand the meaning of the saying. Each item could also have been written in a complete sentence. Rather than reading, “Shows that he/she is a firm…” the wording could be more clear and concise by stating, “[Name of teacher] believes in the idea...” rather than using the words “show”, “firm”, and “believer” that likely conflate understanding and confuse English learners. It may also have helped ELs to eliminate unnecessary words, such as the presence of both him/her and he/she in questions 6, 10, 17, and 22.

Similar issues of incompletion exist with highly skipped questions, like question 20 that includes the word “chronic” and question 40 that includes the concept of

"representation to higher authority". The use of verbose survey questions, high-level vocabulary, and the absence of the MLQ survey in Spanish may have greatly impacted the MLQ data in this research study where only 4 of 61 participants completed the survey in full.

Findings

Academic Achievement: Test on Equations

Overall Performance. While there may not be statistically significant findings from the data in this study, there are many notable trends in the pre-and posttest data. The control group improved more than the treatment group on the posttest overall when analyzing each group's scores on the pretest. The control group averaged 2 points less on the pretest compared to the treatment group, and only averaged 1 point less than the treatment group on the posttest. The fact that the mean difference between classes decreased highlights that the control group performed better on the academic assessment compared to the treatment group because they improved more than the treatment group, and it suggests that the physical classroom had no effect on student performance. It also affirms the null hypothesis to research question 1, which states that there will not be significantly higher assessment averages among the secondary mathematics students in an organized and well-designed classroom environment than students in an unorganized and non-designed classroom environment as measured by a common formative assessment.

It is surprising that the treatment group did not improve at the same rate or more than the control group on the posttest because the physical classroom space is known to correlate to improved engagement and increased academic achievement (Bullard, 2009;

Sahin et al., 2011). Asiyai's (2014) study found that secondary school students' perceptions of the condition of the classroom physical learning environment had a great impact on their learning and motivation, including the motivation to actively participate in academic activities, influencing their academic performance, personal behavior and their school attendance. Despite the research supporting a statistical outcome that might yield more drastic results, students in the control group of this study do not appear to be negatively affected, in terms of their academic achievement, by the lack of design of their classroom environment as evidenced by their test scores that closely mirror the treatment group.

Effective teaching practices utilized by the teacher may have had a greater impact on student achievement than the physical classroom environment effect as evidenced by both classes improving by an average of 43% from the pretest to the posttest. The teacher researcher used identical, best teaching practices while instructing both groups. The teacher presented guided notes effectively (Vintinner et al., 2015), did verbal repetition exercises with all vocabulary (Hernandez et al., 2014), taught a catchy song to reinforce vocabulary (Jackson, 2016; Wisniewski et al., 2013), performed physical representations for all vocabulary words that all students copied (Kieff, 2003), differentiated instruction while students solved practice problems and integrated vocabulary (Heacox, 2012; Tomlinson & Strickland, 2005), checked for understanding, and allowed students to use calculators and notes on the test. As a result of these research-based, best teaching practices, both groups greatly improved their abilities to solve equations and accurately use the words: coefficient, constant, term, isolate, and variable in sentences to explain how to solve an equation.

Performance of English-Only Students. In period 5, the control group, English-only students scored an average of 7.7 points higher than ELs on the pretest, but this average reduced to 1.4 points higher between these groups on the posttest. This suggests English-only students academically improved less than English-learners in the control group. In period 6, the treatment group, English-only students barely outscored English learners on the pretest by an average 0.3 points, but increased this margin to a 1.4 average difference on the posttest, suggesting that English-only students in the treatment group academically improved more than English learners because the mean difference between these two student groups increased from the pretest to the posttest.

The English-only students in the treatment group appear to improve more on the posttest compared to English-only students in the control group. English-only students in the control group scored an average of 1.8 points higher on the pretest (11.6) than English-only students in the treatment group (9.8). However, on the posttest, English-only students in the control group averaged lower scores (18.3) than English-only students in the treatment group (19.2), for a net difference of 2.7 points. This reveals that English-only students in the treatment group improved more than English-only students in the control group.

The design and organization of the classroom environment may have benefitted English-only students in the treatment group as evidenced by their 12% higher academic improvement compared to the English-only students in the control group. Tomlinson and Strickland (2005) refer to the set up presented in the treatment classroom as differentiation of the learning environment, or the way the classroom feels and functions. The treatment classroom effectively differentiates the learning environment for all

students by supplying a word wall to help with vocabulary acquisition (Appendix C, photo 25), presenting clear rules and positive and negative consequences setting clear expectations for behavior (photo 15), organizing a student supply station (photo 8), presenting a unified theme around the room (photos 1-3 and 7), and providing a clean environment that demands respect and academic production. The presentation of a designed and organized learning environment can positively impact academic achievement (Asiyai, 2014; Durmus, 2016; Sahin & Top, 2015).

Performance of English Learners. The English learners improved more from the pretest to the posttest in the control group compared to the treatment group. English learners in the control group averaged 3.9 on the pretest, while English learners in the treatment group averaged 9.5 on the pretest, revealing an average difference of 5.6 points. On the posttest, ELs in the control group averaged 16.9 points compared to ELs in the treatment group who averaged 17.75 points. The average difference in scores among ELs on the posttest between groups was only 0.85 points. English learners in the control group improved much more than English learners in the treatment group because the difference in the means decreased from 5.6 to 0.85 points (22%).

Short Term English Learners (STELs) from the control group experienced the most improvement from the pre to the posttest with a net difference of 12 points more compared to the treatment group. STELs in the control group originally averaged 0 points on the pretest compared to STELs in the treatment group who averaged 10.3 points on the pretest. This 10.3-point difference was eliminated when the control group STELs outperformed the treatment group STELs on the posttest, averaging 19 points compared to the treatment group STELs averaging 17.3 points.

Although the LTELs in the treatment group appear to have notably outperformed the LTELs in the control group by a 15% higher average on the posttest, the LTELs in the control group actually improved more than the LTELs in the treatment group when examining the pretest and posttest scores in tandem. The mean difference between the control and treatment groups on the pretest was 5.9 points. On the posttest, the mean difference was only 3.3 points, revealing that LTELs in the control group averaged greater improvement than LTELs in the treatment group since the mean difference between the groups decreased from 5.9 on the pretest to 3.3 on the posttest.

RFEPs in the control group also improved more on the posttest than RFEPs in the treatment group. On the pretest, the RFEPs in the control group scored an average of 3.2 points less than RFEPs in the treatment group. On the posttest, the RFEPs in the control group scored an average of 1.7 points more than the RFEPs in the treatment group, for a net difference of 4.9 average points. Reclassified English Proficient Students (RFEPs) and STELs in the control group went from scoring lower than their counterparts in the treatment group on the pretest to outscoring them on the posttest, and the LTELs in the control group improved more on the posttest compared to the LTELs in the treatment group.

Although the treatment group presents slightly higher averages on the posttest overall and on each individual question, when comparing the posttest scores to the pretest scores, the data reveals that the control group actually improved more than the treatment group because the difference in the mean scores decreased from the pretest to the posttest for STELs, RFEPs, and LTELs. English-only students in the treatment group are the only subgroup that appears to have improved more than their English-only counterparts in the

control group, suggesting that the designed and organized classroom environment may have had a positive effect on English-only students.

The control group's superior improvement on the posttest compared to the treatment group suggests the designed and organized classroom environment did not have an effect on academic performance. Students in this study appeared to benefit the most from best teaching practices that may have contributed to the control group's superior improvement, especially among English learners, through instructional strategies that have been proven to benefit ELs, such as pairing academic content to song (Jackson, 2016; Wisniewski et al., 2013) and utilizing guided notes (Abuseileek, 2017; Chen & Huang, 2014).

It is also possible that the English learners in the treatment group did not improve at the same rate as their peers in the control group because the teacher did not utilize the components within the treatment classroom designed to help ELs. While a word wall and helpful hints posters were present in the treatment classroom (Appendix C, photos 17, 18, 22-24), the teacher did not incorporate these design elements into instruction in the interest of presenting the academic material in exactly the same way in both classrooms. Alshaiji and Alsaleem (2014) and Hooper and Harmon (2015) found that interactive and frequently used word walls connected to increased language comprehension for English learners. This research demonstrates a positive correlation between word walls and increased language acquisition, suggesting that constructing a word wall may be an effective way to differentiate content and process for students, however, it relies upon the assumption that the word wall is interactive and frequently used. The mere presence of a word wall does not correlate to increased language acquisition and may be a contributing

reason as to why ELs in the control group improved more than ELs in the treatment group, rather than the other way around.

Despite the lack of statistical support from this research study, research has shown that the way artifacts are presented in a physical classroom environment can help students acquire language (Alshaiji & Alsaleem, 2014; Kieff, 2003). Vocabulary word walls, graphic organizers, and visual enrichments are three of many helpful artifacts teachers can display in the classroom environment to help English learners and are known to improve students' language acquisition (Hernandez et al., 2014; Vintinner et al., 2015). The walls within the classroom environment have the ability to visually organize vocabulary and mathematical content that can positively impact students' language development.

Perceptions of Teacher Leadership: Multifactor Leadership Questionnaire (MLQ)

Openness and Ethics. Despite no statistically significant differences in the MLQ results, there are differences in the scores of individual questions between the control and treatment groups (table 32). The treatment group perceived the teacher to seek differing perspectives when solving problems more frequently than the control group (MLQ item 8). Given the differences in the ratings (3.23 compared to 2.8), it appears the treatment group perceives the teacher to be more open-minded and more open to different views than the control group. A similar difference between groups was noted in the statement, "Considers the moral and ethical consequences of decisions" (MLQ item 23). The treatment group revealed a higher rating than the control group, suggesting that there is greater perception of moral and ethical decision-making in the organized and decorated classroom environment.

The treatment group may have perceived the teacher as more open-minded and sensitive to ethics compared to the control group because of the prominent display of a culturally responsive bulletin board in the classroom (Appendix C, photo 9). The "Championing Culture" bulletin board is a form of centering, valuing, and welcoming all students within the classroom environment. The importance of student-centered teaching has already been established (Hedrick, 2012; Sahin & Top, 2015; Tomlinson & Strickland, 2005), and culturally responsive teaching is quickly becoming just as essential (Chouari, 2016). In an article on teachers decorating their doors for Black History Month, Schwartz (2019) noted how representation matters, and this echoes Van De Walle et al.'s (2013) sentiments about the importance of planning with individual student cultures in mind.

Classrooms are likely to be more effective in developing the capacity of students from many backgrounds if teachers understand how culture can shape learning and how teachers can develop classrooms that tap into the intrinsic motivation of culturally diverse learners (Ginsberg, 2005). Culturally responsive teachers make a visible effort to value and esteem the cultures of diverse students. They are prepared for and aware that children bring to school an array of valuable cultural and linguistic experiences that may be similar or dissimilar to those of the teacher or other children in the classroom (Watts-Taffe et al., 2012).

Culturally responsive teaching is especially important for the achievement and sense of belonging for English learners (Penton Herrera, 2017). Teachers committed to differentiating for all students naturally include culturally responsive teaching. One cannot differentiate without being sensitive to culture. The most effective teachers

connect with students, affirm each of their identities, and promote and celebrate their cultures and diversity. One way all teachers can embrace multiculturalism is by dedicating part of the classroom environment to honoring it, like in the form of a "Championing Culture" bulletin board that features multi-cultural clubs and events on campus. The presence of this bulletin board in the classroom environment may be a reason that the treatment group perceived the teacher to be more open to different perspectives and more sensitive to moral and ethical consequences of decisions.

Mission and Productivity. The treatment group also perceived the teacher to have a higher frequency in emphasizing the importance of having a collective sense of mission and getting others to do more than they expect to do over the control group (MLQ items 34 and 39 respectively). The way in which the treatment group's classroom is organized and decorated may have had an impact on students' perceptions of mission and expectations, causing them to rate the teacher higher than the control group in these categories.

The results from the MLQ suggest that a well-designed classroom presenting a class theme may contribute to students' perception of a collective mission, which may positively affect their motivation and performance. Leaders who created an environment of "togetherness" and shared identity, benefitted from employees who experienced higher performance, better mental health, less burnout, greater job wellness, and more engagement at work (Steffens et al., 2014). This sense of unity created an optimal work environment similar to an article on boosting engagement where Qijie (2017) suggested that leaders create a vision of excellence, design meaningful tasks, and build a

community. United community and vision are themes in both articles that correlate to increased engagement.

The treatment classroom presented a theme of We are AZTECS “A Zealous Team of Exceptional Character and Success” that was present on the inside and outside of the door, centered at the top of the front wall of the class, and on the prize cabinet (Appendix C, photos 1, 2, 3, 21). There was no class theme in the control group. A teacher leader can manipulate a classroom environment in such a way as to present a classroom theme that can bring about a collective sense of mission that may boost students’ engagement and sense of unity.

Students’ perceptions of the classroom environment may also influence goal achievement and productivity as evidenced by the treatment group scoring that they were more likely to get more done than they expected to do compared to the control group (MLQ item 39). This increased expectation of accomplishment may be a result of the pristinely organized classroom environment and posted classroom expectations and consequences (Sterling, 2009) (Appendix C, photos 7, 8, 10, 14, 15, 20).

The classroom walls may give off the impression of a teacher’s high level of preparedness, unwavering expectations, expertise, and a teacher’s proven ability to elicit student achievement. In a mixed-methods study on the relationship between student perceptions of teacher-student interactions and motivation in middle school science, Smart (2014) found that students’ perceptions of teacher behaviors were positively correlated with the efficacy for learning science. The way a student perceives teacher behaviors impacts their engagement and efficacy for learning in that teacher’s class. It is possible that, because of students’ impressions of the classroom environment and the

resulting assumptions they made about the teacher's behaviors, they believed the teacher is a leader who will get them to do more than they expected to do.

Church et al. (2001) found that the perceived classroom environment influenced achievement goal adoption, and achievement goal adoption, in turn, directly influenced graded performance and intrinsic motivation. Student perceptions of an environment impact their intrinsic motivation and the level of effort they deem necessary in a course. This appears to be true from the data in this study when students from the treatment classroom rate the teacher as more likely to get others to do more than they expect to do compared to the control group. An organized and well-designed classroom environment may greatly impact students' goals and productivity.

Involvement and Decisiveness. The highest discrepancy in MLQ average ratings comes from students' perceptions of the teacher failing to interfere until problems become serious with a difference of 0.63 (MLQ item 3). The control group perceived the teacher to be less involved and fail to interfere more frequently than the treatment group, who rated the teacher as being more likely to be involved to help with problems before they become serious. The control group also perceived the teacher as more indecisive than the treatment group, with a difference in rating of 0.4 (MLQ item 28).

The treatment group may have perceived the teacher as more involved and more decisive than the control group because of cues from the classroom environment that give off an impression of the teacher as a leader who is likable and willing to serve. The treatment classroom contains pictures of the teacher's family, motifs of past achievements, events and photos of the teacher with former students (Appendix C, photos 6, 19). These items were missing from the control classroom. It is possible that the design

of the classroom environment spurred students to perceive the teacher as likable, helpful, and decisive, which led to more favorable ratings on these questions from the MLQ.

The positive perceptions that come as a result of a well-designed classroom environment may increase motivation and satisfaction in students. Students who perceive their teacher as likable, having positive integrity, and having a willingness to serve are more likely to be satisfied and motivated based on a study on perceptions of leaders and follower's satisfaction (Drescher, 2017). Similarly, Chi and Chi (2014) and Zheng et al. (2020) found that a leader's perceived positive integrity, willingness to serve, uniqueness, and sense of belongingness are connected with employee enthusiasm, physical and mental health, job satisfaction, energy, and perceptions of leader authenticity. When followers believed in a leader's genuine attention to their needs and care for their success, they were much more energized and engaged in their work because they felt supported and resourceful through the leader's attention. Teachers who set up the classroom environment in a way that visually and functionally attends to students' emotional, cultural, academic, supply, and vocabulary needs through word walls (Appendix C, photo 24), bulletin boards with graphic organizers (photo 25), students supply stations (photo 8), and clearly posted and implemented rules and expectations (photo 15), may be more favorably perceived by students than teachers who do not present designed and organized classroom environments.

Develop Strengths. The second largest discrepancy in ratings between the control and treatment groups comes from item 31 on the MLQ, which states, "Helps me to develop my strengths." The control group rated the teacher with an average of 3.32, while the treatment group rated the teacher with an average of 2.78 for a difference of 0.54. The

control group perceived the teacher as a better developer of student strengths compared to the treatment group.

It is important to restate that all students completed this survey before mathematical content began, so this is students' earliest perception of the teacher as a leader and took place before the teacher began teaching/developing math knowledge. It is possible that the designed classroom was perceived by students in the treatment group to be too helpful in terms of providing too much mathematical support on the walls as evidenced by the multiplication chart and negative number rules (Appendix C, photos 17-19) rather than providing the space and autonomy for students to work with the teacher directly to develop strengths. It is also possible that the enrichment of the treatment classroom expressed to students that the teacher already expects them to be strong in mathematics as evidenced by the posted rules and expectations (Appendix C, photo 15), "I love math" poster (photo 13), and helpful hints of perquisite knowledge (photo 6). Perhaps students assumed that the mathematical support presented on the classroom walls would be used to support students rather than the teacher directly.

It is important for the classroom environment to strike a balance where students perceive the environment as welcoming, inclusive, and supportive, but also autonomous enough to work with the teacher to develop their strengths. Students should not perceive the environment as providing too much support or diminishing from the direct work between teacher and student. The concept of developing strengths relates to a principle within differentiated instruction called teaching up. Tomlinson (2009) defines this as a rich, authentic curriculum that is often restricted for only the most able learners, differentiated to lift the majority of students to success with those goals.

Without proper attention to teaching up and accessing students Zones of Proximal Development (ZPD), students spend too much time completing activities that are too easy and do not involve new learning or too little time on tasks that are too difficult and involve too much new learning. The ZPD is the difference between a student's ability to solve problems independently and the potential that the student might reach with the support of a teacher or a more knowledgeable peer in a good learning environment (Tomlinson, 2009; Vygotsky, 1978). The learning task remains the same, but the level of assistance provided to the learner changes (Gredler, 2012), allowing all students to access rigorous curriculum and develop strengths with the leader(s) in the classroom. Students in the treatment group may have perceived the classroom as including items that they thought were too easy or too hard, overloading their ZPDs, and consequently rated the teacher as less likely to help them develop their strengths.

There are important factors and limitations that are specific to this study, like a small sample size, acute time frame, and language barrier on the MLQ, that may have impacted why the data did not trigger as statistically significant. It is important to highlight each of these factors, assess the individual results carefully, present practical significance, and make strategic recommendations for leaders and future research.

Application of Findings and Conclusions to Research Questions

Classroom Environment and Mathematical Performance

Research question 1 includes an inquiry as to whether there is a difference in mathematical academic performance between students who learned in an organized and well-designed classroom and students who learned in an unorganized and non-designed classroom. The exact wording of research question 1 is as follows: what is the difference

in mathematical academic performance, as measured by scores on a common formative assessment, between public high school students who learned math in a well-organized and well-designed classroom and students who learned math in an unorganized and non-designed classroom?

Although academic literature cited in this paper suggests a statistical difference should emerge in favor of the students who learned in an organized and well-designed classroom environment, the data from this study produced no statistically significant results. The absence of statistical significance suggests the classroom environment neither positively nor negatively affected the group of students who learned in the organized and well-designed classroom or the students who learned in the unorganized and non-designed classroom.

Both groups of students in this study demonstrate an average increase in mathematical academic performance of 43% from the pretest scores to the posttest scores, and this suggests that the teacher's best teaching practices may have had a greater impact on students' academic performance compared to the classroom environment. The teacher in this study utilized a song to help students solve equations. The song included special attention to relevant vocabulary words. The teacher also utilized guided notes and practice problems in the form of games and competitions. The results of this study suggest best teaching practices have more of an impact on mathematical student performance than the classroom environment.

Based on the 43% improvement noted in this study, best teaching practices for secondary mathematics, and possibly for other content areas, may be generalized to include pairing academic content and vocabulary to song, providing guided notes, and

facilitating engaging practice activities. Teacher preparation programs and professional development in secondary schools may benefit from training that includes information on how to incorporate music, effective note taking strategies, and engaging practice activities into daily instruction.

English-Only vs. English Learners

A branch of research question 1 is research question 1a, targeting whether there is a difference in mathematical academic performance between learners based on English fluency. Research question 1a reads: what is the difference in mathematical academic performance, as measured by scores on a common formative assessment, between English-only students and English learners who learned math in a well-organized and well-designed classroom and students who learned math in an unorganized and non-designed classroom?

Despite a lack of statistical significance, differences in the rates of improvement on the pretest and posttest emerged among English-only students and English learners. English-only learners from the organized and well-designed classroom improved at a greater rate from the pre- to the posttest than their peers who learned in the unorganized and non-designed classroom. The English-only students who learned in the unorganized and non-designed classroom demonstrated a 6.7-point improvement from the pre- to the posttest, while the English-only students who learned in the organized and well-designed classroom showed a 9.4-point improvement. The English-only students in the treatment group improved an average of 2.7-points more than their EO peers who were in the control group. This reveals that the organized and well-designed classroom environment

may have had a greater impact on English-only students compared to the English learners.

English learners in the unorganized and non-designed classroom improved more from the pre- to the posttest compared to their EL peers who learned in the organized and well-designed classroom environment. English learners in the treatment group improved an average of 8.3 points from the pre- to the posttest, while the ELs in the control group improved an average of 13 points from the pre-to the posttest. English learners in the control group, learning in the unorganized and non-designed classroom, improved an average of 4.7 points more from the pre- to the posttest compared to their EL counterparts in the treatment group.

The data from the sample in this study suggests the classroom environment had no effect on English learners' mathematical performance or language acquisition, and highlights the importance of best teaching practices. The teaching practices utilized by the teacher in this study appear to have the greatest effect on the mathematical performance of ELs. Secondary teachers with English learners may benefit from pairing academic content to song, providing clear notes to students, and facilitating engaging ways for students to practice the content, like games, competitions, or other structured student interactions.

STELs, LTELs, and RFEPs

A second branch of research question 1 is research question 1b, examining whether there is a difference in mathematical academic performance between specific subgroups of English learners. Research question 1b reads: what is the difference in mathematical academic performance, as measured by scores on a common formative

assessment, between Short Term English Learners (STELs), Long Term English Learners (LTELs), and Reclassified English Proficient students (RFEPs) who learned math in a well-organized and well-designed classroom and students who learned math in an unorganized and non-designed classroom?

Short Term English Learners (STELs), LTELs, and RFEPs in this study who learned in an organized and well-designed classroom did not outperform the ELs who learned in an unorganized and non-designed classroom. The lack of statistical significance between groups suggests that there is no difference in mathematical academic performance between ELs who learned in different classroom environments. Short Term English Learners (STELs) in the control group appeared to benefit the most from the teacher's instructional practices with an average improvement of 19 points from the pre- to the posttest. Pairing mathematical content to song/music, utilizing guided notes, and creating engaging practice activities may be most beneficial to STELs.

Long Term English Learners (LTELs) and RFEPs in both groups also benefited from best teaching practices. The LTELs in the control group improved by an average of 10.4 points from the pretest to the posttest, while the RFEPs improved by an average of 13.9 points. The LTELs in the treatment group also demonstrated much improvement, averaging 7 points more from the pre- to the posttest. The RFEPs in the treatment group averaged 9 points more from the pre- to the posttest. All groups improved, but the STELs, LTELs, and RFEPs in the control group improved at a higher rate than the STELs, LTELs, and RFEPs in the treatment group. The superior improvement of ELs in the control group suggests teaching practices that include music, notes, and active practice are more effective in eliciting mathematical performance than the classroom

environment. Secondary teachers with STELs, LTELs, and RFEPs may generate significant academic improvement by pairing academic content to song, presenting instruction with guided notes, and facilitating engaging opportunities to practice.

Classroom Environment and Perception of Teacher Leadership

Research question 2 includes an inquiry as to whether there is a difference in perceptions of a teacher's leadership between students who learned in an organized and well-designed classroom and students who learned in an unorganized and non-designed classroom. Research question 2 is as follows: what is the difference in public high school students' perceptions of teacher leadership between a teacher in a well organized and designed classroom and a teacher in an unorganized and non-designed classroom?

Although academic literature cited in this paper suggests a statistical difference should emerge showing more favorable perceptions of a teacher's leadership from the students who learned in an organized and well-designed classroom environment, the data from this study produced no statistically significant results. The absence of statistical significance suggests the classroom environment neither positively nor negatively affected the perceptions of the teacher as a leader in either group of students.

Despite the lack of statistical significance, the treatment group rated the teacher as a better leader in 6 of the top 7 survey item differences, suggesting that the classroom environment may contribute to more favorable perceptions of the teacher as a leader. The group of students who learned in the organized and well-designed classroom rated the teacher as more open-minded, ethical, committed to a mission, able to elicit productivity, involved, and more decisive than students who learned in the unorganized and non-designed classroom. Secondary teachers who present a classroom environment with a

class theme, student station, word wall, academically relevant graphic organizers, culturally relevant bulletin board, and posted rules and consequences, similar to the classroom in this study, may elicit more favorable perceptions from students about the teacher as a leader.

Application of Findings/Results and Conclusions to the Problem Statement

The purpose of this quantitative study was to assess the impact of a physical classroom environment's design to support all learners, including the subgroups of English-only students and English learners, and whether the environment is associated with increased performance on common formative assessments and more positive perceptions of their teacher's leadership.

The researcher studied two groups of students with similar numbers of English learners, similar ages, same math level, same teacher, same school, and similar times of day. Each class took place in a different classroom environment. The control group took place in an unorganized and non-mathematical and irrelevantly decorated classroom environment (see Appendix B), while the treatment group took place in a pristinely organized, mathematically and relevantly decorated classroom environment (see Appendix C). Each class consisted of roughly 50% English learners, consisting of three subgroups: Short Term English Learners (STELs), Long Term English Learners (LTELs), and RFEPs (Reclassified English Proficient).

The STELs, LTELs, and RFEPs who learned in the pristine physical classroom environment did not exhibit higher academic achievement, improvement, or language acquisition based on the posttest data despite research showing that the physical classroom environment can improve language acquisition (Kieff, 2003), engagement

(Bullard, 2009; Sahin et al., 2011), and academic achievement (Asiyai, 2014; Durmus, 2016; Sahin & Top, 2015).

Underperformance of LTELs

While ELs in the control group academically improved more than ELs in the treatment group on the posttest in this study, it is important to note the gap between the LTEL and the class averages and the English-only averages. Long Term English Learners (LTELs) averaged 12.3 and 15.6 on the posttest in the control and treatment groups, respectively, for a combined average score of 13.95. The class average was 17.6 and 18.5 and the English-only average was 18.3 and 19.2 for control and treatment groups respectively, a combined class average of 18.05 and a combined English-only average of 18.75. This shows that LTELs from both classes scored an average of 4.1 points (18.6%) less than the class average and 4.8 points (21.8%) less than English-only peers. The underperformance of LTELs is a consistent characteristic at Mighty High School and the data from this study illuminates this ongoing issue.

The persistent underperformance of LTELs at the researcher's high school compared to class averages and the averages of English-only peers is a complex leadership issue locally and nationwide. While numbers of English learners in US schools are growing, their academic scores are not advancing at the same pace. In studies on Latino English language learners and bridging achievement gaps, Good et al. (2010) and Marlow (2008) note the consistent underachievement of the EL population compared to English-only peers. The data in this study affirms the educational inequity between English learners and English-only students and echoes the sentiments of current research labeling this discrepancy as a serious and ongoing problem.

Good et al. (2010) found that communication gaps and lack of adequate teacher preparation in multiculturalism, how to effectively teach language acquisition, and ELL instructional strategies were among many reasons Latino English language learners consistently underperformed. The presence of a "Championing Culture" bulletin board as in the treatment classroom (Appendix C, photo 9) may contribute to feelings of safety, welcoming, and cultural sensitivity may serve as a demonstration of a teacher's preparedness in multiculturalism, and a strategy that Good et al. (2010) may consider effective to elicit higher academic engagement and improvement from the EL student population. Regardless of whether the cause is teachers' lack of multiculturalism, ineffective communication, or lack of strategies in teaching language acquisition, English learners are not advancing at the same levels as their English-only peers in this research study, in Mighty High School, or in the greater United States.

Best Teaching Practices

Despite a lack of statistically significant findings in this study, the pre and posttest average scores reveal that English-only students in the treatment group improved more academically compared to English-only students in the control group, while all subgroups of ELs in the control group improved more academically compared to all subgroups of ELs in the treatment group. The superior improvement of students in the control group is counter evidence to the idea that the physical classroom environment has a positive effect on academic achievement (Asiyai, 2014; Bullard, 2009; Durmus, 2016; Kief, 2003). This finding, paired with the overall academic improvement in scores from both classes, suggests that the teacher's effective teaching practices may affect student achievement more than the physical classroom environment.

Effective teaching practices utilized by the teacher may have had a greater impact on student achievement than the physical classroom environment effect as evidenced by both classes improving by an average of 43% from the pretest to the posttest and the superior improvement of STELs, LTELs, and RFEPs in the control group compared to the treatment group. The teacher researcher used identical, research-based, instructional strategies while instructing both groups. The teacher presented guided notes effectively (Vintinner et al., 2015), did verbal repetition exercises with all vocabulary (Hernandez et al., 2014), taught a catchy song to reinforce vocabulary (Jackson, 2016; Wisniewski et al., 2013), performed physical representations for all vocabulary words that all students copied (Kieff, 2003), differentiated instruction while students solved practice problems and integrated vocabulary (Heacox, 2012; Tomlinson & Strickland, 2005), checked for understanding, and allowed students to use calculators and notes on the test.

Music

One reason the ELs in both groups, and particularly in the control group, may have made notable academic improvements on the posttest is because the teacher utilized a song to reinforce vocabulary words related to solving equations. A song's appeal to positive emotion, memory, and accurate pronunciation makes it a superior teaching strategy for English learners. This is likely because music engages emotion, which releases dopamine and norepinephrine, and these chemicals enhance long-term memory (Jensen, 2005). Music can also honor students' out-of-school mathematical experiences and serve as a culturally responsive medium between teacher and student (Kalinec-Craig, 2015).

Music serves as a powerful language acquisition tool and content learning strategy for English learners and students with special needs. According to Jackson (2016) in an article on educational music research, this is because mnemonic devices aid long term retention and appeal to all learning styles. Both Jackson (2016) and Wisniewski et al. (2013) exemplify how the transfer of information is done more accurately and more memorably through song rather than through speech. Embedding musical activities into mathematics instruction help develop students' mathematical understanding and provide an enjoyable experience. As a result, students whose strengths lie in areas other than logical-mathematical intelligence learn mathematics more easily (An et al., 2013; Courey et al., 2012). Based on the favorable research surrounding music, language acquisition, and engagement, the teacher created and presented the following song to help students with equation vocabulary:

To the tune "Hokey Pokey" for solving two-step equations:
You have an equation,
you take the constant out,
you have an equation,
shake the coefficient out,
you isolate the variable,
turn operations around,
that's what it's all about!

This song works best when students have to solve a two-step equation $3x+2 = 14$. The song uses the vocabulary words "equation", "constant", "coefficient", "isolate", "variable", and "operations" and implies the vocabulary words "inverse operations" with the phrase "turn operations around". The order of the song also guides students with operational steps, signaling them to take the "constant out" first and then "shake the coefficient out" second. The constant and coefficient only "come out" by "turning operations around", or using inverse operations. Notable improvements from both classes

in this study and throughout research affirm that music positively correlates to memory and achievement.

Guided Notes

The teacher's notes and students' ability to copy and then access these notes during the posttest may contribute to the academic improvements on the posttest. Watts-Taffe et al. (2012) cited guided notes as a differentiation tool to provide increasing levels of support. The organization of information in this way is a superior teaching strategy because students with special needs and English learners may greatly benefit from mathematical annotation including the color coding of related information, labeling mathematical diagrams, and highlighting key vocabulary in question stems and word problems. Abuseileek (2017) and Chen and Huang's (2014) research highlights the importance of annotation for English learners and its positive impacts on English comprehension.

Students in this study appeared to benefit the most from best teaching practices rather than the design of a classroom environment, and this may have contributed to the control group's superior academic improvement, especially among English learners. The instructional strategies used have been proven to benefit ELs, such as pairing academic content to song (Jackson, 2016; Wisniewski et al., 2013) and utilizing guided notes (Abuseileek, 2017; Chen & Huang, 2014).

Favorable Perceptions

Although there was no statistically significant difference between the treatment and control groups' overall scores on the MLQ survey, six out of the seven survey items with the highest differences in ratings between classes reveal the teacher had more

favorable perceptions from the treatment class than in the control class. Although the treatment class perceived the teacher to be less likely to help students develop their strengths, which may be attributed to the presence of mathematical scaffolding on the classroom walls, the treatment class rated the teacher as more likely to consider moral and ethical consequences of decisions, make decisions, emphasize the importance of having a collective sense of mission, get students to do more than they expected to do, help with problems, and seek differing perspectives when solving problems.

It is possible that students' observations of a non-designed classroom environment in the control group lead them to perceive the teacher as an inferior, or more apathetic, leader than students in the treatment group. In a study on youth perspectives on housing abandonments, Teixeira (2016) found that the participants believed abandoned properties signified no one cared about the neighborhood. Young people perceived pictures of a poorly kept property and made assumptions about the people who live in its environment as apathetic. A similar phenomenon may have happened when students from the control group observed their classroom environment without attention to design or organization, and used their observations to interpose judgment in their perceptions of the teacher who is the presumed owner, facilitator, and organizer of the classroom space (Patrick et al., 2007). A classroom space that appears messy, dirty, disorganized, and in disarray may cause students to doubt or question the teacher's ability to make decisions, help with problems, be open-minded, or elicit productivity as evidenced by the control group's lesser ratings of the teacher's leadership in these areas.

Application to Leadership/Business

The most immediate beneficiaries of this study are: (1) public high school students, including English-only students, STELs, LTELs, and RFEPs (2) secondary teachers (3) secondary administrators and other educational leaders, (4) grant writers, and budget personnel, and (4) educator preparation programs. The findings of this study contribute to the way secondary teachers, secondary administrators, grant writers and budget personnel assign resources, time, and expectations to the physical classroom environment and research-based, best teaching practices. The findings from this study suggest that research-based, best teaching practices that included a song and guided notes had a positive effect on academic achievement based on the 43% average increase from the pre to the posttest.

A lack of statistical significance in this study suggests that the physical classroom environment did not have an effect on students' academic achievement, although English-only students in the treatment group improved more than the English-only students in the control group. The superior improvement of the English learners in the control group compared to the treatment group suggests the effectiveness of music and annotated, guided notes for EL language acquisition and academic achievement since these teaching strategies were used in both classes.

As a result of the research cited in this study and the favorable perceptions shown in the MLQ results, educational leaders may better understand the importance of secondary physical classroom environments, deserving of just as much time, attention, detail, and organization as elementary-level classrooms in order to best support all students. This study may contribute to future research on how to use classroom walls to

organize academic content (Hooper & Harmon, 2015; Jackson, 2018), scaffold, provide visual enrichments, and project positive expectations (Sterling, 2009) that will elicit favorable perceptions from students toward their teacher.

The California Standards for the Teaching Profession (CSTP) include six standards. Standard 2 is about, "creating and maintaining effective environments for student learning" (Commission on Teacher Credentialing). Creating an effective environment for student learning is a top educational leadership issue, second on the list of only six of teaching profession standards. Creating and maintaining effective environments for students learning is a prominent standard for the teaching profession because of the environment's proven correlation to improve language acquisition (Kieff, 2003), boost engagement (Bullard, 2009; Sahin et al., 2011), and increase academic achievement (Asiyai, 2014; Durmus, 2016; Sahin & Top, 2015). Although the concept of the learning environment makes up 17% of the standards for the teaching profession, many secondary teachers neglect their learning environments altogether (Afzal, 2013; Dorman et al., 2006; Durmus, 2016), creating spaces void of student voice, student culture, expectations, relevant topics or vocabulary, and graphic organizers.

Although the study did not produce statistically significant results, students in the treatment classroom perceived the teacher to be more open to differing perspectives, more likely to consider the moral and ethical consequences of decisions, have a greater collective sense of mission, get others to do more than they expected to do, be decisive, and be more involved than the control group. This study begins to fill in the gaps that persist regarding many secondary school districts' lack of expectation about classroom environment, and reaffirms the importance of using research-based, best teaching

practices like pairing academic content to song and guided note taking that greatly helped the ELs in this study. Teachers, administrators, district and budget personnel may need to reexamine what teaching practices their staff uses to meet EL needs and how to allocate financial resources to bring about classroom environment transformations.

The persistent underperformance of LTELs is an important consideration for educational leaders across the nation (Good et al., 2010; Marlow, 2008) and within the researcher's high school. The gap in performance between LTELs and the rest of the class and English-only students is also apparent in this study. LTELs from both classes scored an average of 4.1 points (18.6%) less than the class average and 4.8 points (21.8%) less than English-only peers. While numbers of English learners in US schools are growing, their academic scores are not advancing at the same pace. The data in this study affirms the educational inequity between English learners, particularly LTELs, and English-only students and echoes the sentiments of current research labeling this discrepancy as a serious and ongoing problem in Mighty High School and in the greater United States.

While much literature exists on the impact of classroom design on elementary students, this study is the first of its kind in examining the possible impact that classroom design has on secondary student academic achievement and perceptions of teacher leadership. Despite a lack of statistically significant evidence from this acute, small (n=63) study, much research supports the idea that an optimal classroom environment positively impacts student engagement in school and may consequently improve graduation rates and life outcomes as well. As a result, establishing high expectations of

organization and design of secondary classroom environments may formalize into an educational leadership issue that is worthy of attention and prioritization in the future.

Recommendations for Action

There are multiple avenues for action based on the results of this study that could include professional development, 1:1 coaching, and purchasing classroom organization and design materials. The end result includes a call for all secondary teachers to utilize research-based, best teaching practices to elicit academic achievement and create spaces in their classroom to erect student work, use an active vocabulary word wall, post and consistently enforce clear rules and expectations, unify around a class theme, consider an incentive system, hang a culturally relevant bulletin board, post academic support/hint/graphic organizer posters, and set up a space to house supplies for student to use to elicit favorable perceptions from students. A secondary classroom environment with these elements is beneficial for all students. Any improvements to a classroom environment may boost students' engagement, improve students' academic achievement, and appeal to their sense of belonging and inclusion in school because of the impact that an effective learning environment can have on all students, especially English learners.

Professional Development

Educational leadership should provide professional development for teachers that present research and rationale for creating optimal classroom learning environments and best teaching practices, including examples of effective classroom design and organization. Gregory et al. (2014) found that training teachers for one year positively shifted engagement across secondary schools. When teachers were trained and coached, not only did they become better leaders, but students' engagement and academic

performance also increased. Providing effective professional development may spur teachers to action and bring about positive outcomes for students.

Professional development training can also be useful to help teachers with teaching diverse students and to promote a climate of change. In a study that identifies and describes the most effective competencies in teaching culturally and linguistically diverse students, Chouari (2016) discovered that special training, extra competencies, and culturally responsive pedagogies were most effective in multicultural teaching settings. Special training on the importance and impact of classroom environment may improve teachers' skills in teaching the diverse populations in their classrooms. Special training on the effectiveness of pairing academic content to song for ELs may also improve academic performance. Training can also spark openness to change. In a study on providing university administrators with tools and motivations to broaden the gender equality culture and encourage a climate of change, Bystydzienski et al. (2017) found that training can shift attitudes and alter departmental culture beyond policy and procedure, highlighting the impact training can have on organizational climate. Proper professional development may contribute to a culture of change within an organization, as it opens the eyes and the minds of those participating to new ways of thinking and new ways of implementing best practices.

Coaching

Educational leaders can fund classroom design coaches to help teachers who struggle envisioning an ideal classroom design and can work together to formulate a plan and actualize a classroom transformation. In a study on the role of coaching in leading organizational change, Rosha and Lace (2015) found that coaching could accelerate

leadership development, strategic thinking, and collaboration in organizations. The collaboration between teachers and design coaches is an important component in the success of an organizational change like improving the design and organization of a classroom environment because the positive interdependence between coach and teacher propels the work forward and brings about action. Collaboration between teachers and coaches can also increase teachers' use of best teaching practices if teachers and coaches share songs, instructional materials, or notes that were shown to elicit academic improvement in this study. Coaching acts as a force for the success of an organizational change. Several other prominent researchers in the field of education and business agree with these sentiments about the benefits of coaching, highlighting how it also acts as short-term accountability in implementing change (Cady, 2019; Gregory et al., 2014; Kotter, 2012).

Purchase Classroom Design Materials

Educational leaders can also allocate proper funds to buy organizational supplies and classroom design resources that are most relevant to high school teachers. These items may include: a poster machine, large laminator, border, letters, butcher paper, magnetic tape, color printer(s), storage drawers, pencils, pens, highlighters, and more. The presentation of a teacher's walls, furniture, supplies, and cleanliness has the ability to spark creativity, autonomy, and knowledge within students, positively impacting academic achievement (Asiyai, 2014; Durmus, 2016; Sahin & Top, 2015). This study also suggests the presentation of the classroom may bring about favorable perceptions of the teacher. Many secondary teachers are aware that they should improve their classroom environment, but neglect doing so due to a lack of adequate resources (Durmus, 2016)

and lack of expectation from administration. If administrators expect high school teachers to present effective classroom environments, then adequate funding is necessary to provide teachers with the necessary supplies to do so.

If a school takes action to pursue professional development, fund coaches, and/or fund classroom supplies in order to improve students' learning environments, an accountability and monitoring system may need to be in place. One way to monitor a classroom design change initiative is to create a system where administrators clearly express expectations about classroom environment and then provide targeted feedback to teachers based on classroom observations. If school leadership states that all teachers must have a color-coded word wall, then this should be added to an observational checklist so administrators can look for this during formal and informal observations.

Recommendations for Further Research

There is a great need to continue researching the possible impact that a classroom environment can have on high school students. A gap remains between elementary and high school research on the impact of classroom decoration and organization. This scope of this study only examines two Integrated Math II classes. Future research should look into studying all subject areas, in grades 9-12, over a period of an entire school year, and with the largest sample size as possible, not less than n=134 per the G*Power analysis in figure 11.

A way to ensure the sameness of a teacher in future studies could be to record the lessons and watch with the students during class. This ensures the way the academic material is taught and presented is identical in both control and treatment groups. In this

study, the researcher taught each group in person and used scripts to remain as identical as possible, but exact sameness was not possible.

It also may be beneficial to research one classroom design item at a time rather than all the classroom design items at the same time. The treatment classroom in this study included a word wall, a helpful hints graphic organizer wall, posted rules and consequences, a class theme, a “championing culture” bulletin board, and an organized student station. It may be best for future research to examine one of these items at a time to see if one has a greater impact on student performance and perception than another.

Future research may consider changing the leadership perceptions survey from the MLQ to one that is more accessible and easy to understand. Although a valid and reliable survey instrument, the MLQ was difficult for both English learners and English-only students. The MLQ does not appear to be student-friendly in terms of how the questions are written and the choices of words and phrases. It may also benefit future researchers to translate the leadership perceptions survey into the home language of the English learners. In this research study, an MLQ in Spanish may have helped many students better understand the questions.

Future research that may have a greater chance in yielding statistically significant results could include collecting responses from a leadership perceptions survey, similar to the MLQ, with open-ended questions where students provide qualitative responses rather than quantitative responses. Instead of administering the MLQ survey on paper or online where students read and answer the questions independently, more complete surveys may have resulted if the survey was administered in the form of a 1:1 interview, as a qualitative instrument. The presence of an interviewer allows students to ask for help if

they need a question translated in Spanish, and/or ask for clarification of what a phrase or word means. Students could receive clarification and understanding from the researcher before answering the question. A qualitative instrument may be better for a high school age group and/or a population with a high percentage of English learners because the interview questions can be rephrased, repeated, translated in a student's home language, or confirmed for a shared understanding before the student answers the question. Qualitative, 1:1 interviews would also likely dissuade students from skipping any interview questions and avoid the problem in this study of incomplete MLQs.

Concluding Statement

The purpose of this quantitative, causal comparative study was to measure the impact that a classroom design initiative could have on all learners, including English-only students and English learners, by comparing the means of two different class periods of students' perception ratings of their teacher and their academic performance on a mathematics common formative assessment at a low-income public high school in the Pacific southwest. The data from the common formative assessment and the perceptions ratings of the teacher did not yield any statistically significant differences between the class period conducted in an organized and decorated classroom environment and the class period conducted in an unorganized and non-decorated classroom environment.

Future research that replicates this study with a larger sample size and greater longevity may find statistically significant results to support that an organized and well-designed classroom environment is beneficial to high school students. Statistically significant findings would validate all the literature cited in this paper claiming the

classroom environment is known to correlate to improved language acquisition and academic achievement.

The organized and designed classroom environment appears to have increased the engagement and academic performance of English-only students. All subgroups of English Learners, including LTELs, STELs, and RFEPs, in the control group did not appear to be negatively affected by the unorganized and non-designed classroom environment, but rather, academically improved at a superior rate compared to their peers in the treatment group. This suggests that effective teaching practices had a greater effect on EL academic performance than classroom environment.

The control and treatment groups appeared to rate the teacher's leadership the same as evidenced by their similar average scores on the MLQ and statistical insignificance between the means of both groups. However, the group that attended class in an organized and decorated environment rated the teacher as more open-minded, decisive, involved, more sensitive to ethics/morals, and able to elicit more from the students than they think they can do.

Educational leaders are in a position to prioritize standard 2 from the California Standards for the Teaching Profession by setting aside funding to create and maintain effective environments for student learning. Future research in secondary school classroom decoration should further define what makes a classroom environment "effective" by studying classroom elements one by one. Future research can paint a clearer picture of what exact elements need to be present in every public high school classroom to help all students succeed. The purpose of this study is to discover a new avenue of how to make education more equitable by fostering new ways to present an

inviting, organized, and academically helpful classroom environment to low-income, public high school students. Based on the limitations of the study and the many factors that prevented the production of statistically significant results, this preliminary research represents a first step in proposing the use of classroom walls, decoration, and organization to create a more optimal learning environment for all public high school students.

REFERENCES

Abuseileek, A. (2017). An integrative approach based on using annotations and computer-mediated feedback to support learners' proficiency in the English language. *International Journal of Learning Technology, 12*(2), 165-185. doi:10.1504/IJLT.2017.086383

Afzal, S. (2013). Teachers' awareness about relationship between classroom organization and students' learning achievement. *Journal of Research in Social Sciences, 1*(1), 155-164. https://www.proquest.com/scholarly-journals/teachers-awareness-about-relationship-between/docview/1458584359/se-2

Allen, J. P., Hafen, C. A., Gregory, A. C., Mikami, A. Y., & Pianta, R. (2015). Enhancing secondary school instruction and student achievement: Replication and extension of the my teaching partner– secondary intervention. *Journal of Research on Educational Effectiveness.* doi:10 .1080/19345747.2015.1017680

Alshaiji, O. A., & Alsaleem, B. I. (2014). The impact of word walls on improving the English reading fluency of Saudi kindergarten's children. *Education*, *135*(1), 39-50. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=98971606&site=ehost-live&scope=site&custid=s5391840&authtype=sso

An, S., Capraro, M. M., & Tillman, D. A. (2013). Elementary teachers integrate music activities into regular mathematics lessons: Effects on students' mathematical abilities. *Journal for Learning through the Arts,* 1 – 19. doi: 10.21977/D99112867

Apuke, O. D. (2017). Quantitative research methods a synopsis approach. *Kuwait Chapter of the Arabian Journal of Business and Management Review, 6*(11), 40-47. doi:10.12816/0040336Argenti, P. A. (2017). Strategic communication in the c-suite. *International Journal of Business Communication, 54*(2), 146-160. doi:10.1177/2329488416687053

Asiyai, R. (2014). Students' perception of the condition of their classroom physical learning environment and its impact on their learning and motivation. *College Student Journal, 48*(4), 716-726. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=100358667&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Astuti, S. P. (2013). Teachers' and students' perceptions of motivational teaching strategies in an Indonesian high school context. *TEFLIN Journal, 24*(1), 14-31. doi:10.26686/wgtn.17008573.v1

Avolio, B. J., & Bass, B. M. (2004). *Multifactor leadership questionnaire manual and sample set*, 3rd ed. Mind Garden, Inc.

Bagozzi, R.P., Yi, Y., & Phillips, L.W. (1991). Assessing construct validity in organizational research. *Administrative Science Quarterly*, 36, 421-458. doi:10.2307/2393203

Bullard, J. (2009). *Creating environments for learning: Birth to age eight*. New Jersey: Merrill.

Bystydzienski, J., Thomas, N., Howe, S., & Desai, A. (2017). The leadership role of college deans and department chairs in academic culture change. *Studies in Higher Education, 42*(12), 2301-2315. doi:10.1080/03075079.2016.1152464

Cady, S. H. (2019) Collaborative change: Generative approaches that transform organizations, revitalize communities, and develop human potential. *OD Practitioner, 51*(2), 21-25. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=bsu&AN=135759020&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Carter, M. J., & Fuller, C. (2015). Symbolic interactionism. *Sociopedia*, *1*(1), 1-17. doi:10.1177/205684601561

Cavanagh, R. F. (2015). A unified model of student engagement in classroom learning and classroom learning environment: One measure and one underlying construct. *Learning Environments Research, 18*(3), 349-361. doi:10.1007/s10984-015-9188-z

Cavendish, W., Marquez, A., Roberts, M., Suarez, K., & Lima, W. (2017). Student engagement in high-stakes accountability systems. *Perspectives on Urban Education*, *14*(1), 1-4. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=126185171&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Chen, C. M., & Huang, S. H. (2014). Web-based reading annotation system with an attention-based self-regulated learning mechanism for promoting reading performance. *British Journal of Educational Technology, 45*(5), 959-980. doi:10.1111/bjet.12119

Chen, M., Wu, T., & Wu, H. (2016). The study of constructing learning environment indicators for principals' instruction leadership. *Xuexiao Xingzheng Shuangyuekan (School Administrators),* (104), 15-38. doi:10.3966/160683002016070104002

Chi, J. L., & Chi, G. C. (2014). Perceived executive leader's integrity in terms of servant and ethical leadership on job burnout among Christian healthcare service providers: Test of a structural equation model. *Journal of Management Research, 14*(4), 203-226. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=bsu&AN=129238209&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Chouari, A. (2016). Cultural diversity and the challenges of teaching multicultural classes in the twenty-first century. *Arab World English Journal, 7*(3), 3-17. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=118449705&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Church, M. A., Elliot, A. J., & Gable, S. L. (2001). Perceptions of classroom environment, achievement goals, and achievement outcomes. *Journal of Educational Psychology*, *93*(1), 43-54. doi:10.1037/0022-0663.93.1.43

Cialdini, R. B. (2006). *Influence: The psychology of persuasion*. Harper Business.

Commission on Teacher Credentialing. (2009, October). *California standards for the teaching profession (CSTP).* https://www.ctc.ca.gov/docs/default-source/educator-prep/standards/cstp-2009.pdf

Courey, S. J., Balogh, E., Siker, J. R., & Paik, J. (2012). Academic music: Music instruction to engage third-grade students in learning basic fraction concepts. *Educational Studies in Mathematics,* 81(2), 251 – 278. doi:10.1007/s10649-012-9395-9

Dogan, C. D., & Uluman, M. (2017). A comparison of rubrics and graded category rating scales with various methods regarding raters' reliability. *Kuram Ve Uygulamada Egitim Bilimleri, 17*(2), 631-651. doi:10.12738/estp.2017.2.0321

Dorman, J. P., Aldridge, J. M., & Fraser, B. J. (2006). Using students' assessment of classroom environment to develop a typology of secondary school classrooms. *International Education Journal, 7*(7), 906-915. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=507936898&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Drescher, G. (2017). Delegation outcomes: Perceptions of leaders and follower's satisfaction. *Journal of Managerial Psychology, 32*(1), 2-15. doi:10.1108/JMP-05-2015-0174

Durmus, Y. T. (2016). Effective learning environment characteristics as a requirement of constructivist curricula: Teachers' needs and school principals' views. *International Journal of Instruction, 9*(2), 183-198. doi:10.12973/iji.2016.9213a

Falkner, A., & Payne, K. A. (2020). But all your walls are blank! *YC Young Children, 75*(4), 32-37. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=145510447&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Fernet, C., Trepanier, S.-G., Austin, S., Gagne, M., & Forest, J. (2015), Transformational leadership and optimal functioning at work: On the mediating role of employees' perceived job characteristics and motivation. *Work & Stress, 29*(1), 11-31. doi:10.1080/02678373.2014.1003998.

Freeman, J., Simonsen, B., McCoach, B., Sugai, G., Lombardi, A., & Horner, R. (2015). An analysis of the relationship between implementation of school-wide positive behavior interventions and supports and high school dropout rates. *High School Journal, 98*(4), 290-315. doi:10.1353/hsj.2015.0009

Fulmer, R. M., & Brock, J. E. (2014). Developing peer coaching. *Graziadio Business Review*, *17*(2), 1–5. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=bsu&AN=118657082&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Gandini, L. (1998). *Educational and caring spaces. In The hundred languages of children. The Reggio Emilia approach-Advanced reflections,* 2nd ed. Ablex.

Gass, K. M., & Laughter, J. C. (2015). "Can I make any difference?" Gang affiliation, the school-to-prison pipeline, and implications for teachers. *The Journal of Negro Education*, *84*(3), 333-347. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=113233646&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Gibson, J. J. (1966). *The Senses Considered as Perceptual Systems.* Houghton Mifflin.

Ginsberg, M. G. (2005). Cultural diversity, motivation, and differentiation. *Theory Into Practice, 44*(3), 218-225. doi:10.1207/s15430421tip4403_6

Good, M., Masewicz, S., & Vogel, L. (2010). Latino English language learners: Bridging achievement and cultural gaps between schools and families. *Journal of Latinos & Education, 9*(4), 321-339. doi:10.1080/15348431.2010.491048

Gredler, M. (2012). Understanding Vygotsky for the classroom: Is it too late? *Educational Psychology Review*, 24(1), 113-131. https://link.springer.com/article/10.1007/s10648-011-9183-6

Gregory, A., Allen, J. P., Mikami, A. Y., Hafen, C. A., & Pianta, R. C. (2014). Effects of a professional development program on behavioral engagement of students in middle and high school. *Psychology in the Schools, 51*(2), 143-163. doi:10.1002/pits.21741

Gregory, R. L. (1970). *The intelligent eye*. McGraw-Hill Book Company.

Grosse, S. (2019). Children with PTSD: Teachers Can Make a Difference. *Delta Kappa Gamma Bulletin, 86*(2), 30-33. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=143272543&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Haber, R. N. (1968). *Contemporary Theory in Research in Visual Perception*. Holt, Rinehart & Winston, Inc.

Han, H., Moon, H., & Lee, H. (2019). Physical classroom environment affects students' satisfaction: Attitude and quality as mediators. *Social Behavior and Personality, 47*(5), 1-10. doi:10.2224/sbp.7961

Hattie, J. (2009). *Visible learning. A synthesis of over 800 meta-analyses relating to achievement.* Routledge.

Heacox, D. (2012). *Author spotlight on Diane Heacox, author of differentiating instruction in the regular classroom* [Video]. Youtube. https://www.youtube.com/watch?v=9AmpPtePnoE

Hedrick, K. A. (2012). Differentiation: A strategic response to student needs. *Education Digest, 78*(4), 31-36. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=83883065&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Hernandez, A., Montelongo, J., Delgado, R., Holguin, R., & Carmona, L. (2014). Strengthening vocabulary instruction for Latino English learners: Cognate word walls and anchor charts. *New Mexico Journal of Reading, 34*(2), 36-40. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=97289253&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Hooper, J., & Harmon, J. (2015). The many faces of word walls in middle school science classrooms: Variability in function and content. *Science Scope, 38*(6), 54-59. doi:10.2505/4/ss15_038_06_54

Ismail, S. N., Muhammad, F., Kanesan, A. G., & Yaacob, A. (2018). Teacher collaboration as a mediator for strategic leadership and teaching quality. *International Journal of Instruction, 11*(4), 485-498. doi:10.12973/iji.2018.11430a

Jackson, I. (2016). Educational music research: A letter from us. *Educational rap. Rhythm, rhyme, results.* http://www.educationalrap.com/educational-music-research/

Jackson, J. (2018). Build an interactive word wall: Connecting scientific concepts with academic vocabulary. *Science Teacher, 85*(1), 42-46. doi:10.2505/4/tst18_085_01_42

Jensen, E. (2005). *Teaching with the brain in mind.* 2nd ed. Alexandria, VA: Association for Supervision and Curriculum Development.

Jimerson, S. R., & Haddock, A. D. (2015). Understanding the importance of teachers in facilitating student success: Contemporary science, practice, and policy. *School Psychology Quarterly, 30*(4), 488-493. doi:10.1037/spq0000134

Kalinec-Craig, C. (2015). Uncovering the mathematical challenges and connections when using mariachi music as a representation for teaching equivalent fractions. *Journal of Mathematics Education*, 8(2), 4 – 21. https://core.ac.uk/download/pdf/144709293.pdf

Kenny, D. A., & Kashy, D. A. (1992). Analysis of multitrait-multimethod matrix by confirmatory factor analysis. *Psychological Bulletin*, 112, 165–172. doi:10.1002/9781118901731.iecrm0161

Kephart, N. C., & Floyd, W. (1954). Classroom environment and pupil welfare. *Journal of Educational Psychology, 45*(1), 52-59. doi:10.1037/h0063232

Kieff, J. (2003). Winning ways with word walls. *Childhood Education, 80*(2), 84I-84L. doi:10.1080/00094056.2004.10521263

Kotok, S. (2017). Unfulfilled potential: High-achieving minority students and the high school achievement gap in math. *The High School Journal, 100*(3), 183-202. doi:10.1353/hsj.2017.0007

Kotter, J. P. (2012). *Leading change.* Harvard Business Review Press.

Lekwa, A. J., Reddy, L. A., Dudek, C. M., & Hua, A. N. (2019). Assessment of teaching to predict gains in student achievement in urban schools. *School Psychology, 34*(3), 271-280. doi:10.1037/spq0000293

Losch, S., Traut-Mattausch, E., Muhlberger, J. E. (2016). Comparing the effectiveness of individual coaching , self-coaching, and group training: How leadership makes the difference. *Front Psychology, 629*(7). doi:10.3389/fpsyg.2016.00629

Marlow, K. (2008). *Closing the achievement gap for English language learners: A comparison of language arts/esol and one-way developmental bilingual.* (Publication No. B02F97FD9B8833AC) [Doctoral dissertation, University of Central Florida]. OpenDissertations. https://stars.library.ucf.edu/etd/3569

Mason, M. (2010). Sample size and saturation in PhD studies using qualitative interviews. *Forum: Qualitative Social Research, 11*(3), 8, http://nbn-resolving.de/urn:nbn:de:0114-fqs100387

Moos, R. H., & Trickett, E. J. (1986). *Classroom environmental scale manual* (2nd ed.). Consulting Psychologists Press.

Patrick, H., Ryan, A. M., & Kaplan, A. (2007). Early adolescents' perceptions of the classroom social environment, motivational beliefs, and engagement. *Journal of Educational Psychology, 99*(1), 83-98. doi:10.1037/0022-0663.99.1.83.

Pellegrino, J.W., Baxter, G.P. & Glaser, R. (1999). Addressing the two disciplines problem: linking theories of cognition and learning with assessment and instructional practice. *Review of Research in Education, 24,* 307-53. doi:10.2307/1167273

Penton Herrera, L. J. (2017). The key is differentiation: Recognizing the literacy and linguistic needs of indigenous Hispanic students. *Literacy Today, 34*(6), 8-9. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=122980729&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Popham, W.J. (1997). What's wrong and what's right with rubrics. *Educational Leadership, 55*(2), 72-5. https://www.skidmore.edu/assessment/handbook/Popham_1997_Whats-Wrong_and-Whats-Right_With-Rubrics.pdf

Qijie, C. (2017). Enhance student engagement through leadership strategies. *Transformative Dialogues: Teaching & Learning Journal, 9*(3), 1-7. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=122522312&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Reddy, M. Y. (2011). Design and development of rubrics to improve assessment outcomes. *Quality Assurance in Education, 19*(1), 84-104. doi: 10.1108/09684881111107771

Rinaldi, C. (1998). *Children, spaces, relations: Metaproject for an environment for young children.* Reggio Children.

Rockinson-Szapkiw, A. J. [The Doctoral Journey]. (2013, June 6). *Developing a quantitative research plan: Choosing a research design* [Video file]. http://www.youtube.com/watch?v=UywO2XuFuBA

Rosha, A., & Lace, N. (2015). Sustainable development and behavioral patterns: To innovations through coaching. *Journal of Security & Sustainability Issues, 5*(2), 171-180. doi:10.9770/jssi.2015.5.2(4)

Sahin, A., & Top, N. (2015). STEM students on the stage (SOS): Promoting student voice and choice in STEM education through an interdisciplinary, standards-focused, project based learning approach. *Journal of STEM Education:*

Innovations & Research, 16(3), 24-33. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=110317029&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Sahin, I. T., Erden, F. T., & Akar, H. (2011). The influence of the physical environment on early childhood education classroom management. *Eurasian Journal of Educational Research (EJER), 44*(1), 185-202. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=85090064&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Salkind, N. J. (2017). *Statistics for people who think they hate statistics* (4th ed.). Thousand Oaks, CA: SAGE.

Sarason, S. B. (1990). *The predictable failure of educational reform: Can we change course before it's too late?* (1st ed.). San Francisco, CA: Jossey-Bass.

Schmid, C. L. (2001). Educational achievement language-minority students, and the new second generation: a Magazine of Theory and Practice. *Sociology of Education*, 71-87. doi:10.2307/2673254

Schwartz, S. (2019, February 15). *Teachers decorating their doors for Black History Month say representation matters.* Education Week Teacher. https://www.edweek.org/teaching-learning/teachers-decorating-their-doors-for-black-history-month-say-representation-matters/2019/02

Shih, S. (2015). The relationships among Taiwanese adolescents' perceived classroom environment, academic coping, and burnout. *School Psychology Quarterly, 30*(2), 307-320. doi:10.1037/spq0000093

Simco, N. (1996). *Display in the classroom: Principles, practice and learning theory*. David Fulton.

Smart, J. B. (2014). A mixed methods study of the relationship between student perceptions of teacher-student interactions and motivation in middle level science. *RMLE Online, 38*(4), 1-19. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=100327926&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Sousa, M., & Dierendonck, D. (2017). Servant leadership and the effect of the interaction between humility, action, and hierarchical power on follower engagement. *Journal of Business Ethics, 141*(1), 13-25. doi:10.1007/s10551-015-2725-y

Steffens, N. K., Haslam, S. A., Kerschreiter, R., Schuh, S. C., & Van Dick, R. (2014). Leaders enhance group members' work engagement and reduce their burnout by crafting social identity. *Zeitschrift Fur Personalforschung, 28*(1/2), 173-194. doi:10.1688/ZfP-2014-01-Steffens.

Sterling, D. R. (2009). Classroom management: Setting up the classroom for learning. *Science Scope, 32*(9), 29-33. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=508075980&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Teixeira, S. (2016). Beyond broken windows: Youth perspectives on housing abandonment and its impact on individual and community well-being. *Child Indicators Research, 9*(3), 581-607. doi:10.1007/s12187-015-9327-1

Tomlinson, C. A. (2009). Intersections between differentiation and literacy instruction: Shared principles worth sharing. *New England Reading Association Journal, 45*(1), 28-33. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=508034506&site=ehost-live&scope=site&custid=s5391840&authtype=sso

Tomlinson, C. A., & Strickland, C. A. (2005). *Differentiation in practice: A resource guide for differentiating curriculum, grades 9-12.* ASCD. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=nlebk&AN=137597&site=ehost-live&scope=site&custid=s5391840&authtype=sso&ebv=EB&ppid=pp_C

Tunca, N. (2015). The regression level of constructivist learning environment characteristics on classroom environment characteristics supporting critical thinking. *Eurasian Journal of Educational Research,* (60), 181-200. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eue&AN=114074960&site=ehost-live&scope=site&custid=s5391840&authtype=sso

United States. National commission on excellence in education. (1983). *A nation at risk: The imperative for educational reform: A report to the nation and the secretary of education, United States Department of Education*. Washington, DC: The Commission.

Van De Walle, J., Karp, K., & Bay-Williams, J. M. (2013). *Elementary and middle school mathematics: Teaching developmentally* (8th ed.). Pearson.

Vintinner, J. P., Harmon, J., Wood, K., & Stover, K. (2015). Inquiry into the efficacy of interactive word walls with older adolescent learners. *High School Journal, 98*(3), 250-261. doi:10.1353/hsj.2015.0007

Vygotsky, L.S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Watts-Taffe, S., Laster, B. P., Broach, L, Marinak, B., McDonald Connor, C., & Walker-Dalhouse, D. (2012). Differentiated instruction: Making informed teacher decisions. *Reading Teacher, 66*(4). 303-314. doi:10.1002/TRTR.01126

Wilson, J., & Kelling, G. (1982). The police and neighborhood safety: Broken windows. *The Atlantic Monthly*, *127*, 29-38. doi:10.4324/9781315087863-11

Wisniewski, M. G., Mantell, J.T., & Pfordresher, P.Q. (2013). Transfer effects in the vocal imitation of speech and song. *American Psychological Association*, 23(2), 82 – 99. doi:10.1037/a0033299

Zbeik, R. M., & Larson, M. R. (2015). Teaching strategies to improve algebra learning. *The Mathematics Teacher, 108*(9), 696-699. doi:10.5951/mathteacher.108.9.0696

Zheng, M. X., Yuan, Y., van Dijke, M., De Cremer, D., & Van Hiel, A. (2020). The interactive effect of a leader's sense of uniqueness and sense of belongingness on followers' perceptions of leader authenticity. *Journal of Business Ethics, 164*(3), 515-533. doi:10.1007/s10551-018-4070-4

APPENDIX A

Multifactor Leadership Questionnaire Rater Form and Instructions

The paper version of the Multifactor Leadership Questionnaire showing all 45 questions is pictured below. The paper version was not used in this study, but it is included here to show all 45 questions at once and to show the frequency scale point values.

Multifactor Leadership Questionnaire
Rater Form

Name of Leader: _____ Date: _____

Organization ID #: _____Leader ID #: _____

This questionnaire is used to describe the leadership style of the above-mentioned individual as you perceive it. Answer all items on this answer sheet. **If an item is irrelevant, or if you are unsure or do not know the answer, leave the answer blank.** Please answer this questionnaire anonymously.

Important (necessary for processing): Which best describes you?

___ I am at a higher organizational level than the person I am rating.
___ The person I am rating is at my organizational level.
___ I am at a lower organizational level than the person I am rating.
___ Other than the above.

Forty-five descriptive statements are listed on the following pages. Judge how frequently each statement fits the person you are describing. Use the following rating scale:

Not at all	Once in a while	Sometimes	Fairly often	Frequently, if not always
0	1	2	3	4

The Person I Am Rating. . .

1.	Provides me with assistance in exchange for my efforts	0	1	2	3	4
2.	*Re-examines critical assumptions to question whether they are appropriate	0	1	2	3	4
3.	Fails to interfere until problems become serious	0	1	2	3	4
4.	Focuses attention on irregularities, mistakes, exceptions, and deviations from standards	0	1	2	3	4
5.	Avoids getting involved when important issues arise	0	1	2	3	4
6.	*Talks about his/her most important values and beliefs	0	1	2	3	4
7.	Is absent when needed	0	1	2	3	4
8.	*Seeks differing perspectives when solving problems	0	1	2	3	4
9.	*Talks optimistically about the future	0	1	2	3	4
10.	*Instills pride in me for being associated with him/her	0	1	2	3	4
11.	Discusses in specific terms who is responsible for achieving performance targets	0	1	2	3	4
12.	Waits for things to go wrong before taking action	0	1	2	3	4
13.	*Talks enthusiastically about what needs to be accomplished	0	1	2	3	4
14.	*Specifies the importance of having a strong sense of purpose	0	1	2	3	4
15.	*Spends time teaching and coaching	0	1	2	3	4

Continued ➔

Not at all	Once in a while	Sometimes	Fairly often	Frequently, if not always
0	1	2	3	4

16. Makes clear what one can expect to receive when performance goals are achieved	0	1	2	3	4
17. Shows that he/she is a firm believer in “If it ain’t broke, don’t fix it.”	0	1	2	3	4
18. *Goes beyond self-interest for the good of the group	0	1	2	3	4
19. *Treats me as an individual rather than just as a member of a group	0	1	2	3	4
20. Demonstrates that problems must become chronic before taking action	0	1	2	3	4
21. *Acts in ways that builds my respect	0	1	2	3	4
22. Concentrates his/her full attention on dealing with mistakes, complaints, and failures	0	1	2	3	4
23. *Considers the moral and ethical consequences of decisions	0	1	2	3	4
24. Keeps track of all mistakes	0	1	2	3	4
25. *Displays a sense of power and confidence	0	1	2	3	4
26. *Articulates a compelling vision of the future	0	1	2	3	4
27. Directs my attention toward failures to meet standards	0	1	2	3	4
28. Avoids making decisions	0	1	2	3	4
29. *Considers me as having different needs, abilities, and aspirations from others	0	1	2	3	4
30. *Gets me to look at problems from many different angles	0	1	2	3	4
31. *Helps me to develop my strengths	0	1	2	3	4
32. *Suggests new ways of looking at how to complete assignments	0	1	2	3	4
33. Delays responding to urgent questions	0	1	2	3	4
34. *Emphasizes the importance of having a collective sense of mission	0	1	2	3	4
35. Expresses satisfaction when I meet expectations	0	1	2	3	4
36. *Expresses confidence that goals will be achieved	0	1	2	3	4
37. Is effective in meeting my job-related needs	0	1	2	3	4
38. Uses methods of leadership that are satisfying	0	1	2	3	4
39. Gets me to do more than I expected to do	0	1	2	3	4
40. Is effective in representing me to higher authority	0	1	2	3	4
41. Works with me in a satisfactory way	0	1	2	3	4
42. Heightens my desire to succeed	0	1	2	3	4
43. Is effective in meeting organizational requirements	0	1	2	3	4
44. Increases my willingness to try harder	0	1	2	3	4
45. Leads a group that is effective	0	1	2	3	4

The MLQ instructions were sent to participants via email. The instructions from the email are pictured below:

Please fill out this survey about what you think about Mrs. Mendoza's leadership so far.

Dear [redacted]

You have been identified as someone who can provide ratings for developmental purposes for Allison Mendoza (ajs00v@gmail.com). There are other raters also completing this survey for Allison Mendoza. Your ratings will be aggregated with the other ratings which will provide development feedback to Allison Mendoza. This aggregation is to assist you in providing direct and honest feedback to Allison Mendoza since you will not be identified with your ratings.

NOTE: The questions/behaviors in this survey are identical regardless of your relationship to the person you are rating. Focus on the frequency of behaviors exhibited by the person you are rating rather than on your relationship to him or her. Note also that usually higher level ratings (e.g., supervisor) consist of only one person and so are not aggregated.

Regarding the textual input questions, your answers will not be edited. The report to Allison Mendoza will contain exactly what you enter.

To complete your rating of Allison Mendoza, please click or copy into your browser address bar to access the Web page rating form: you can also use [redacted] in most email programs or by a copy and paste into your browser address bar.

For the purposes of this evaluation, you should respond by: **ASAP**.

The online administration of the MLQ is pictured below. Participants received 10 questions at a time until all 45 questions were answered. Any responses marked “unsure” were recorded as a blank box (unanswered), and not a 0, when the survey data and point values per question were exported to Microsoft excel.

* 8. Seeks differing perspectives when solving problems.

Unsure	Not at all	Once in a while	Sometimes	Fairly often	Frequently, if not always

* 9. Talks optimistically about the future.

Unsure	Not at all	Once in a while	Sometimes	Fairly often	Frequently, if not always

* 10. Instills pride in others for being associated with him/her.

Unsure	Not at all	Once in a while	Sometimes	Fairly often	Frequently, if not always

Items marked by * are required.

Next >

APPENDIX B

Photos of control classroom environment (period 5)

Photo 1

Photo 1 shows an overall span of control classroom, where period 5 took place. Note the desks are in rows; there are flags of different countries hanging from the ceiling with the corner of one flag on the far left falling down. Much of the wall space contains either blank space, random patches of pennants or memorabilia, and areas where white poster paper patches over items on the walls.

Photo 2

Photo 2 shows the right side of the classroom, highlighting a station for student materials on the right side. There is a cardboard box of posters blocking the student station, and supplies on top of the table of the student station that appear to be jumbled, and not

assigned to any particular place. There is also a basket full of random items under the table. Along the right side of the photo, there are many items out of place on top of student desks and a cooler and other various, random items up towards the teacher desk. There is no particular attention to bulletin boards or academically enriching items on the wall.

Photo 3

Photo 3 zooms in on the table intended for student materials to highlight the lack of organization in this area of the classroom. There appears to be a cup of pencils, cup of highlighters, a plastic tub with various items, a stapler, hole puncher, tissues, pencil sharpener, calculators in a dish, rulers, lotion, a lint roller, and other various bowls and/or containers. There is also a case of drinks on the floor to the right of the table (pink box to right of poster box). The items are not labeled with clear, designated areas, and this area is not clearly marked as a place for students to access materials.

Photo 4

Photo 4 provides another overall span of the classroom from an alternate angle to photo 1. From this angle, a crumpled roll of paper towels is atop a water dispenser. Another roll of paper towels, a stack of red cups, a cooler, and baby wipes also appear in this photo.

Photo 5

Photo 5 highlights the lack of theme, color, or academic enrichment on the wall of the classroom. There are flags pictured, but no graphic organizers that are content-related or helpful hints posters. In the bottom right corner of the photo, the teacher desk also appear to have multiple items out of place such as a hair tie, soda can, coffee cup, sticky note, an open box, and a marker.

Photo 6

Photo 6 is similar to photo 5 in that it highlights the lack of theme, color, or academic enrichment on the wall of the classroom. There is also a hanger out of place on a student desk on the left side of the photo. The teacher desk also contains some items out of place as noted in photo 5.

Photo 7

Photo 7 shows items out of place on the desks in the front row of the classroom, such as a grocery bag, money box, and items in the chair.

Photo 8

Photo 8 shows the teacher area. Some of the items in the right shelf appear to be thrown in there and unorganized. While this area does not appear to be unclean or significantly disorganized, it does not appear to be pristinely organized as evidenced by the multiple items on top of the bookshelves and microwave, and the way the items are presented within the bookshelves with no label and no clear designated area.

Photo 9

Photo 9 highlights some of the items out of place in the classroom, such as the hanger, grocery bag, power strips, and the empty basket on the floor that does not have any clear purpose for being there.

Photo 10

Photo 10 is a picture of the front left corner of the classroom. It shows a “Join or Die” flag, “polling place sign”, cups of noodles, Emergen – C box, a map of the US, and a Dr. Seuss poster. All of these items are either out of place or are not items that are academically relevant to the topic at hand, which is solving equations.

Photo 11

Photo 11 shows the left wall of the classroom, void of any posted rules, expectations, class theme, word wall, or designed bulletin board.

Photo 12

Photo 12 shows a bookshelf in the back left corner of the classroom that has a large, unused, printer-like machine in the bottom. This does not appear to be in its proper place and does not appear to be a functioning tool that the teacher utilizes.

Photo 13

Photo 13 shows the back wall of the classroom and features a metal, wired cart that is being stored, in addition to more power strips and extension cords that are out of place on student desks.

Photo 14

Photo 14 spans the classroom from the back left corner. More flags are visible behind the teacher area. Four pennants hang above the large whiteboard on the opposite wall. Desks are also facing a different direction along the back wall and are not facing forward.

Photo 15

Photo 15 highlights the front wall of the classroom, showing the projection consists of a white pull down screen and a projector mounted to the ceiling.

APPENDIX C

Photos of treatment classroom environment (period 6)

Photo 1

Photo 1 is a photo of the treatment class from the outside of the building to show the attention to class theme (We are AZTECS – A Zealous Team of Exceptional Character and Success) featured on the door and school pride.

Photo 2

Photo 2 zooms in on the door to show the theme again and school colors (school acronym is MOH) and school motto “The relentless pursuit of excellence”.

Photo 3

Photo 3 shows the interior of the door is an exact replica as what appear on the outside of the door. It reinforces the class theme of “We are AZTECS”.


Welcome!
Room 519
Mrs. Mendoza
We are
A
Zealous
Team of
Exceptional
Character &
Success
Integrated Math
AVID

Photo 4

Photo 4 is a photo of the entire classroom from the front right angle. Desks are in rows facing forward.

Photo 5

Photo 5 is another photo of the whole classroom from the same angle as photo 4, but is zoomed out to include the teacher area in the back right corner and more of the back wall.

Photo 6

Photo 6 features the back wall of the classroom. There is a bulletin board on the right showing photos of the teacher. There is a sign labeled, “Key Concepts” with posters of negative number rules for multiplying and dividing, how to add negative numbers, a multiplication table, old formulas, equation vocabulary, and a large multiplying, dividing, adding, and subtracting symbols on the far right with common math words inside each that signal each operation. Centered over the back table is a sign “Student Station” which signals to students that everything in that area is for their use. The teacher desk in the picture also appears clean, with no items out of place.

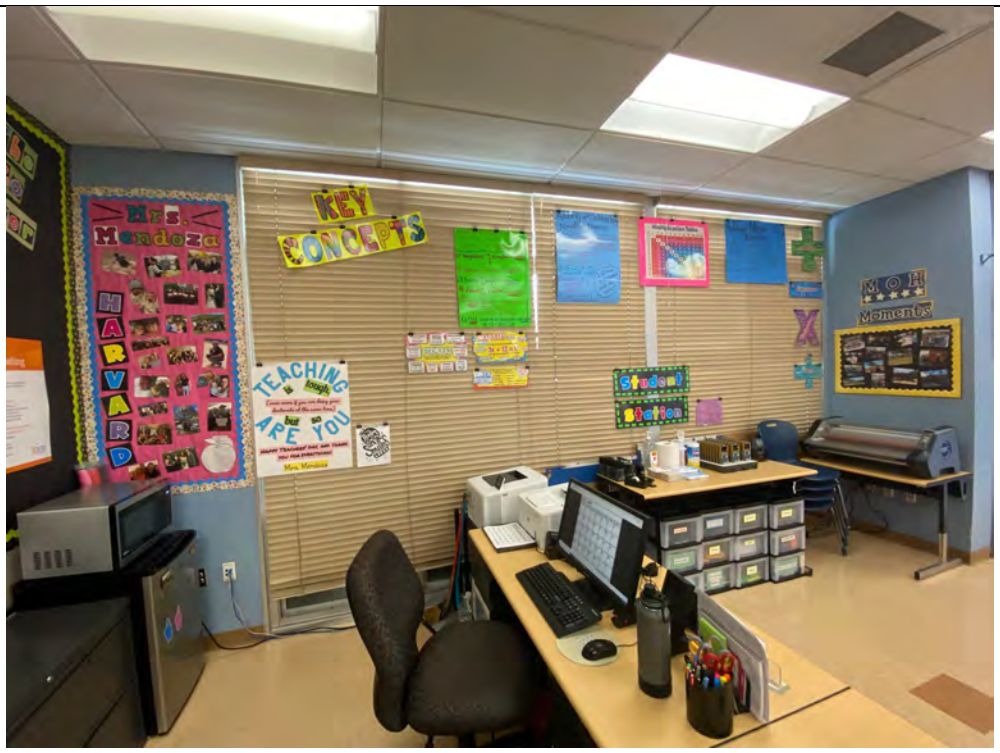


Photo 7

Photo 7 is a picture of the treatment classroom from the back right angle. This also shows the cleanliness of the teacher desk, the signs on the front wall above the Smart board and white boards that say “We are a Zealous Team of Exceptional Character and Success”. The prize cabinet is also in this photo in the front right of the classroom labeled “AZTEC Awards”.

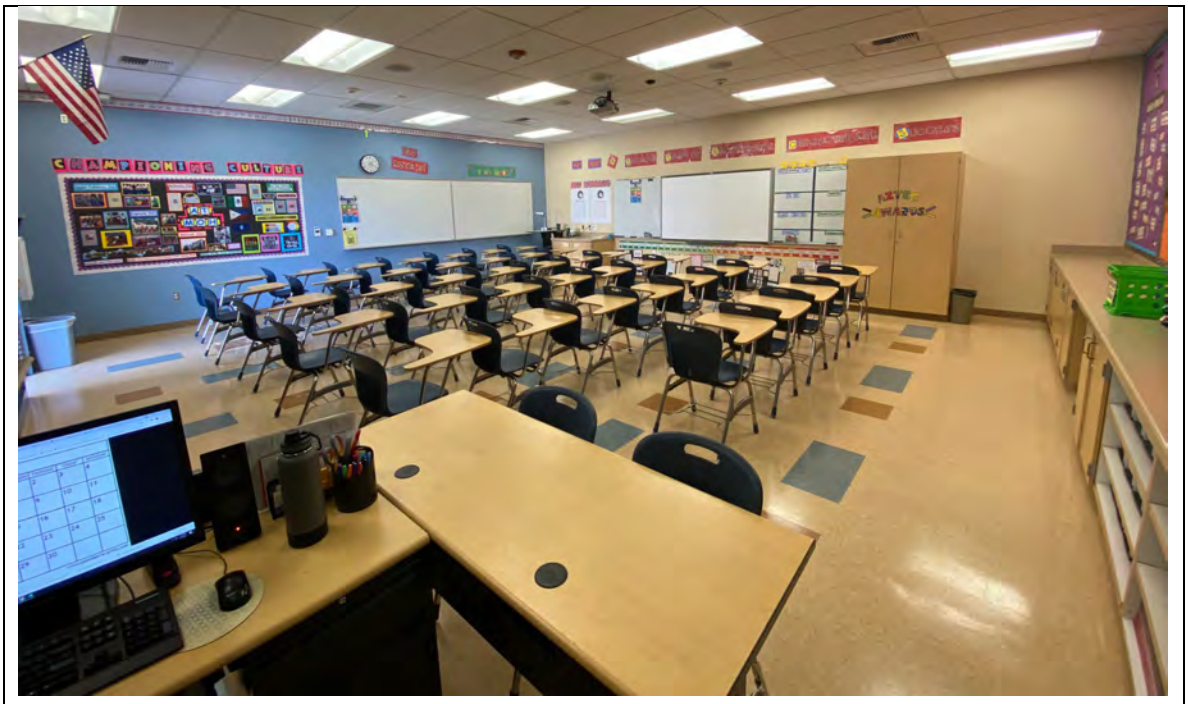


Photo 8

Photo 8 zooms in on the student station. The purple paper posted to the left of the "Student Station" sign is a cheat sheet for students to use if they forgot their passwords to any of the school's commonly used websites such as Jupiter grades or logging into their computers. The table appears uncluttered with each item having a designated space. The calculators are presented in order, along with a cup of pencils, a pencil sharpener, sanitation supplies, tissues, tape, stapler, and a basket to organize the mini erasers and whiteboard markers for students'' mini whiteboards. Under the table are 12 drawers that are also labeled with supplies for student use, such as, graph paper, lined paper, printer paper, hole punchers, flash cards, mini whiteboards, Crayola markers, highlighters, rulers, nurse passes, and more.

Photo 9

Photo 9 shows a “Championing Culture” bulletin board that is on the left wall of the classroom as soon as one walks in the door. It features culturally relevant clubs on campus and culturally sensitive movements that value all.

Photo 10

Photo 10 shows the right wall of the classroom. The far left is the rules and consequences board, the middle is the word wall, and the far right is the AVID Juniors section. Each section of the wall has a clear purpose with signs/banners and color coordination.

Photo 11

Photo 11 shows the posters displayed on the back wall by the door. There is a section for pennants and college memorabilia to the right of the door. To the left of the door is an "always" poster that reinforces the rules of the classroom.

Photo 12

Photo 12 shows the clearly labeled bell schedules that are displayed on the front wall of the classroom to the left of the whiteboards.

Photo 13

Photo 13 shows the left side of the classroom, featuring a number line that expands the length of the entire wall, a “Go Aztecs!” poster, and an “I Love Math!” banner. The “Championing Culture” bulletin board (photo 9) is on the far left.

Photo 14

Photo 14 shows the graphic organizer used to display the daily learning target, agenda, essential question, and homework each day. Blue is for Integrated Math 2 and green is for AVID 11.

Photo 15

Photo 15 zooms in on the “Rules and Consequences” bulletin board. This is clearly labeled and permanently posted in the classroom. Its feature in the classroom design reaffirms its permanency and consistency of use, leaving no excuse for students to say they did not know about classroom expectations.

Photo 16

Photo 16 shows the AVID Junior bulletin board and shows the cleanliness of the teacher area with the fridge, microwave, and coffee maker cleaned and in designated areas that may not be confused as a student area.

Photo 17

Photo 17 zooms in on a few of the “Key Concepts” posters. This picture features the negative number rules when multiplying and dividing (green poster), adding and subtracting negative number rules (blue poster), and key formulas, vocabulary, and order of operations posters that should be review for the students in this level of math.

Photo 18

Photo 18 zooms in on the rest of the “Key Concepts” posters on the back wall of the classroom. This picture features the multiplication table and a song the teacher used to review how to add negative numbers (blue poster).

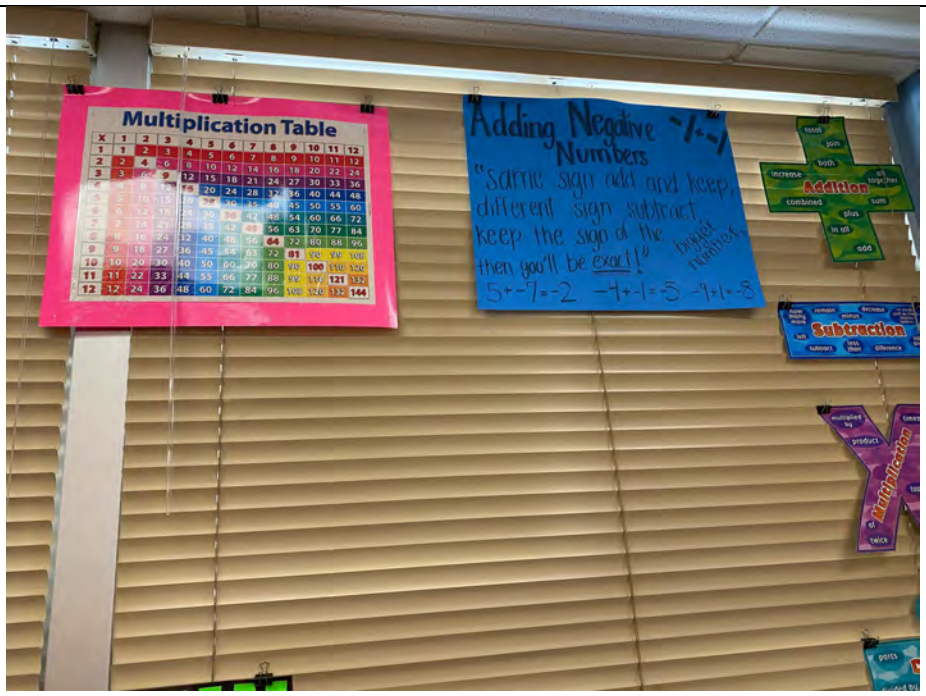


Photo 19

Photo 19 shows a small bulletin board of previous memories the teacher has from the school, such as a team photo of a past basketball team, photos of class games, photos of previous field trips, and teacher coffee dates. To the left of this bulletin board are the large addition, subtraction, multiplication, and division symbols that are on the far right of the “Key Concepts” wall.

Photo 20

Photo 20 shows the attention to organization in the treatment classroom. There are labeled drawers for all classroom materials. These materials are separate from the student station as they are teacher-materials. All items have a designated placement.

Photo 21

Photo 21 shows the front of the classroom and the projection materials. The treatment classroom has a Smart board that is front and centered in the classroom, as well as a mounted projection unit in the ceiling.

Photo 22

Photo 22 shows the prominence of the word wall.

Photo 23

Photo 23 zooms in on the word wall and the “Absent basket” and “Input/Output” trays that are on the counter. This shows an organized area for students to check when they are absent, as well as clearly labeled areas to turn in work “input” or get graded work “output” that is presented for each period.

Photo 24

Photo 24 exemplifies what the word wall looks like at the end of the semester.

Adjectives, nouns, and verbs are color-coded and there are examples provided for each word on the word wall.

Photo 25

Photo 25 shows that the “Key Concepts” wall looks like at the end of a semester. Posters are added as new content is added. Posters including the 5 triangle congruence theorems, 3 similarity theorems, trigonometry, area models, factoring, and 7 angle relationships are shown in this picture, in addition to the ones already outlined in photos 17-19.

APPENDIX D

IRB Approval Form

CityUniversity of Seattle

www.CityU.edu

206.239.4800 [Main]
800.426.5596 [Toll-Free]
City University of Seattle
521 Wall Street, Suite 100
Seattle, WA 98121

Institutional Review Board
Certificate of Approval

IRB ID# Mendoza_Pack081021

Principal Investigator (if faculty research):
Student Researcher: Allison Mendoza
Faculty Advisor: Dr David Pack
Department: SEL

Title: A quantitative study into the effects of the physical classroom environment on secondary mathematics students' academic achievement and perceptions of teacher leadership.

Approved on: August 10, 2021

- ☐ Full Board Review
- X Expedited Review (US)
- ☐ Delegated Review (Can)
- ☐ Exempt (US)

CERTIFICATION

City University of Seattle has reviewed the above-named research project. The proposal was found to be acceptable on ethical grounds. The Faculty Advisor Dr David Pack and the student researcher Allison Mendoza have the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original Ethical Review Protocol submitted for ethics review.
This ***Certificate of Approval*** is valid provided there is no change in experimental protocol, consent process, or documents. Any significant changes to your proposed method, or your consent and recruitment procedures are required to be reported to the Chair of the Institutional Review Board in advance of its implementation.

Brian Guthrie

Brian Guthrie Ph D
Chair, IRB City University of Seattle

IORG-IRB REGISTRATION: IORG 0009788/IRB registration number: IRB000627 CITY UNIVERSITY of SEATTLE IRB #1. FWA00030892

APPENDIX E

Organization (School District) Approval Form

CityUniversity

Organizational Informed Consent Form

Name of Organization Montgomery High School, Sweetwater Union High School District

Address 1130 5th Ave
City, State, Zip Chula Vista, CA 91911
Telephone (619) 691-5564

By signing this consent form, I understand that Allison Mendoza (the researcher) is a ☒ candidate for an advanced degree, or ☐ a faculty member of City University of Seattle. I understand that the researcher is conducting a study entitled A Quantitative Study Into the Effects of the Physical Classroom Environment on Secondary Mathematics Students' Academic Achievement and Perceptions of Teacher Leadership. The purpose of this research is to identify the impact that a classroom's organization and design has on students' perceptions of their teacher's leadership and to identify the impact that a classroom's organization and design has on students' mathematical academic performances..

I understand the findings of this research study are solely the responsibility of the researcher. It is understood that any and all information/data the researcher collects from contacts within and/or about our organization outside the research protocol will not be part of the research findings. I understand the researcher may publish findings following completion of this study. Any information published will be limited to the findings of the research. No research participants will participate in this study without organization and City University of Seattle Institutional Review Board (IRB) knowledge and approval.

☒ I grant the researcher permission to contact members of the organization for the purpose of requesting participation in the study as required by the research design.

☒ I grant the researcher permission to use organizational premises as necessary to conduct the research.

☒ I grant the researcher permission to collect, use, and store organizational documentation related to the project under study. I understand that in granting permission to access organizational documentation, the researcher will store copies in a secure manner outside of the organization in a secure manner as approved by the City University of Seattle IRB.

☒ The researcher will maintain all documentation and findings regarding this organization in confidence and confine its use to this research study.

☒ On behalf of the organization, I request a final copy of this research report.

Daniel Winters — 7/17/2021

Organization Representative and signature — Date

Print Name and Title Dr. Daniel Winters, Chief of System Improvement and Innovation
Organization Sweetwater Union High School District

Name of Research Supervisor or Advisor: Dr. David Pack