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From the editor:

Welcome to the first edition of our new journal, Middle Level Education in Texas (MLET). MLET is an online journal published by Professors of Middle Level Education in Texas (POMLET). POMLET is the newly formed Texas affiliate of National Association of Professors of Middle Level Education (NAPOMLE). Our goal is to provide both scholarly and practitioner-based articles for teachers, school administrators, and university faculty involved in middle level education in Texas and across the country. We have included four great articles in this first edition and expect this is just the beginning of some great journals!

MLET is published twice each year. I encourage researchers and practitioners to submit articles for review. I also encourage you to join POMLET and become an advocate for middle level education in the Texas. The links for POMLET membership and MLET submission guidelines are provided below.

POMLET membership: http://pomlet.weebly.com/membership.html

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Socioeconomic Status and Mathematics: A Critical Examination of Mathematics Performance in Grades Three through Eight by Mathematical Objective

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Abstract

This quantitative research study examined TAKS mathematics performance data across socioeconomic identifiers and found statistically significant differences were observable in grade three across all objectives between students' not identified as economically disadvantaged and students' receiving free meals. The highest number of quantifiable differences occurred between the mean scores of students' identified as not economically disadvantaged scoring significantly higher on objective means than students' receiving free meals or identified as other economically disadvantaged. After students' move beyond the third grade, the number of statistically significant differences drastically reduces. By the eighth grade, statistical differences are difficult to locate. An examination of within group data did not identify any statistical significance.

Introduction

The *1966 Coleman Report* (Coleman et al., 1966) positioned discussions of educational achievement at the forefront of conversations in the United States. The report magnified that a myriad of factors influence educational achievement and educational attainment. One major acknowledgement in the *Coleman Report* was that socioeconomic status was a major predictor of educational achievement and attainment (Knapp & Woolverton, 2004). Generally, students with higher socioeconomic status have an enhanced chance of reaching higher levels of educational attainment and academic achievement (Coleman et al., 1966; Goldstein, 1967; Knapp & Woolverton, 2004; Mayeske et al., 1972; Persell, 1993). Students who are not academically successful either choose to leave school or are forced out before graduation (Orfield, 2004). One societal impact of the difference in achievement is the correlation of academic success to students leaving school before graduation. Orfield (2004)

analyzed the drop out crisis and identified the relationship between the dropout rate and social challenges. Students who drop out or are pushed out are more likely to earn significantly lower wages over time than students and have an increased likelihood of being incarcerated during their lifetime than students who receive a high school diploma (Howard, 2010). There is an economic trickling effect in regard to student dropout rate.

A student's performance in K-8 mathematics often holds the key to the preparatory mathematics track that a student will have access to in high school and postsecondary education (Oakes et al., 2006). Within the scope of achievement, mathematics and reading receive a tremendous amount of attention. Howard (2010) acknowledges that mathematics and reading are foundational content areas within the educational experience of a student. He emphasizes that careful attention to performance gaps in mathematics and reading will provide "considerable implications for overall success…improving students' performance in other academic areas" (p. 19). Gay (2009) notes that when a subject area holds an elite status, such as mathematics, a certain level of positive and negative bias trickles down and influences students educational experiences and opportunities in that subject area. In turn, students of color, students living in poverty, and students living with connection to other descriptive factors that are in contrast with the determining dominant group are left without receiving the same educational opportunity to access, experience, and expectations (Gay, 2009; Moses & Cobb, 2001; Tate, 1997b).

Ladson-Billings (1995b) stated that "all students can be successful in mathematics when their understanding of it is linked to meaningful cultural referents, and when the instruction assumes that all students are capable of mastering the subject matter" (p. 141). Performance gap differences provide researchers with clear insights that differences exists, but "how the values and beliefs assigned to different subjects (and aspects within them) affect student and teacher attitudes toward them" (Gay, 2009, p. 192) is less known. Gay emphasizes that:

> …revisioning the socially constructed identity of mathematics, accepting the culturally responsive as a requirement of quality education for ethnically different students, and crafting instructional actions that exemplify them are crucial components of teachers' preparation if they are to provide more equitable learning opportunities for diverse students (p. 193).

Addressing academic achievement, Gay urges educators to critically analyze achievement differences as they relate to students of color and students living in poverty. Stemming from the belief that mathematics achievement occurs in a cultural context, environmental factors must influence scoring. Factors to consider may include the inexperience of test-taking cultural capital, self-concept, self-efficacy, self-esteem, or teacher expectations on academic achievement (Gay, 2009). Research pertaining to mathematics achievement by specific topic across any sociocultural variable is difficult to locate (Lim, 2008; Lubienski & Bowen, 2000). The research attainable lacks specificity and is often very generic (Lim, 2008). Tate (2005) acknowledges that mathematics performance data are often unavailable to researchers and educational

leaders and therefore calls for more specific analysis of mathematics performance data across various demographics to inform and influence education.

The primary objective of this research study was to identify any significant differences in TAKS mathematics achievement in grades three through eight across socioeconomic identifiers. Mathematics TAKS data were examined across grades three through eight in 2004, 2007, and 2010 by specific mathematical objective across socioeconomic status. The intent of the study was to provide a foundational data set for K-8 decision makers, mathematics teacher educators, and researchers to make informed decisions. The data set also provides a basis to expand on theory and praxis in mathematics education.

This article provides a brief summary of the history of Texas assessment programs followed by an overview of TAKS mathematics objectives before reviewing the issue of socioeconomic identifiers and educational influence. Before moving into the research methodology, a description of culturally responsive pedagogy is provided. After describing the guiding research methods, the findings are reported, followed by a discussion that includes closing remarks**.**

A Brief History of Texas Assessments

Texas students have been required to participate in statewide assessment in the content areas of reading, writing, and mathematics since 1980 (TEA, 2002a). The first required assessment was labeled the Texas Assessment of Basic Skills (TABS) test. TABS was a criterion-referenced assessment from 1980 through 1984 (Cruse & Twing, 2000). Students were assessed in grades three, five, and nine. A mandated statewide curriculum was not available in the early 1980s and the learning objectives were created by various committees of Texas educators. By 1983, students who did not pass the grade nine assessments were required to retake the exam each year until they passed it. However, not passing TABS did not eliminate students from receiving their diploma or graduating (Cruse & Twing, 2000). TABS assessment results were available to the public.

In 1985, Texas students began taking another criterion-reference assessment labeled the Texas Educational Assessment of Minimal Skills (TEAMS). The Texas legislature pushed for a change in terminology and shifted focus from “basic skills” to “minimum basic skills” (Cruse & Twing, 2000, p. 328). TEAMS also assessed reading, writing, and mathematics, but included grades one, three, five, seven, nine, and eleven. By 1987, all students were required to pass the eleventh grade “exit level” assessments to receive their diploma. TEAMS was eliminated in 1989.

Beginning in 1990, Texas replaced TEAMS with another criterion-referenced assessment labeled the Texas Assessment of Academic Skills (TAAS). TEA (2002b) claims that the TAAS shifted away from *minimum skills* toward *academic skills*. TAAS emphasized *higher-order thinking* and *problem-solving* across reading, writing, and mathematics. TAAS was administered in grades three, five, seven, nine, and eleven. TAAS emphasized a broader focus on the essential elements (EE) and was more difficult than the TEAMS. TAAS also provide more information regarding scores and

accountability. Students, campuses, and districts were all accountable for student performance and were susceptible to receiving consequences for not meeting state expectations. TAAS phased out in 2002 and opened the door for the Texas Assessment of Knowledge and Skills (TAKS).

The Texas legislature desired a more rigorous assessment program and desiring to curtail social promotion and created a law that would mandate that students meet certain expectations to exit certain grade levels. Students were required to pass TAKS reading and receive passing grades in grade three to be promoted to grade four. Students in grades five and eight were required to receive passing grades and pass TAKS reading and mathematics assessments to be promoted to the next grade level. The exit-level assessment was moved back to the eleventh grade and students were required to pass TAKS reading, mathematics, science, social studies, and writing in order to be eligible to receive a diploma. Students were also required to earn sufficient high school credits. TAKS has undergone several changes since its inception. Reading is now assessed in grades three through nine; English-language arts (ELA) is administered in tenth and eleventh grades; writing is assessed in fourth and seventh grades; mathematics is administered in third through eleventh grades; science is administered in fifth, eighth, tenth, and eleventh grades; and social studies is administered in the eighth, tenth, and eleventh grades. As of 2010, students in grade three are no longer required to pass TAKS reading to be promoted to the fourth grade.

Texas is now transitioning toward the State of Texas Assessments of Academic Readiness (STAAR). STAAR will use End of Course (EOC) assessments in grades nine through twelve. Freshman classes beginning in the 2011-2012 academic year will be required to take five EOC assessments as a partial requirement to graduate (TEA, 2010). Students will be expected to pass EOC assessments in Algebra I, Biology, English I, English II, and United States History. In grades three through eight, students will take annual assessments in both reading and mathematics.

TAKS Mathematics Objectives

TAKS assessed mathematics across six objectives through multiple-choice and griddable items. Objective one explored numbers operations, and quantitative reasoning. Objective two explored patterns, relationships, and algebraic reasoning. Objective three explored geometry and spatial reasoning while objective four explored measurement. Objective five explored probability and statistics and objective six explored mathematical processes and tools. Mathematics TAKS assessment began with 40 test items in grade three and increased by two items per grade through the eighth grade assessment which had 50 test items.

Objective one was heavily emphasized in both the elementary and middle grades to build a mathematical foundation on number fluency (TEA, 2002a). The emphasis on objective two increased as students approached Algebra. The emphasis on objective three remained constant through grades three through eight (TEA, 2002a). Objective four received more emphasis in elementary school than middle school. The focus on measurement decreased as students start focusing more on algebraic foundations (TEA, 2002a). Objective five was emphasized more in the middle grades than in grades

three through five. Objective six received a heavy emphasis throughout elementary and middle level grades. Objective six attempted to link knowledge and skills from the other five objectives and push students to think critically and to effectively problem solve (TEA, 2002a). A single test item will be represented by a combination of content from multiple objectives (TEA, 2002a).

Socioeconomic Status

Many researchers suggest that socioeconomic status is a major predictor in student achievement (Coleman et al., 1966; Jordan et al., 2007; Knapp & Woolverton, 2004; Persell, 1993). When examining data in Texas, Tajalli and Ophein (2005) found that socioeconomic status was a significant factor in predicting academic performance of fourth and eighth graders. Students from low-socioeconomic backgrounds receive less support than many of their peers from other backgrounds (Jordan et al., 2006).

Jordan and Levine (2009) explored the socioeconomic variation, number competence, and mathematics learning for young children. The foundation of their study is on the premises of "primary preverbal number knowledge and symbolic number knowledge" (p. 61). Jordan and Levine describe primary preverbal number knowledge as an object file system for precise representation of small numbers and an analogue magnitude system for approximate representation of larger sets. They describe secondary symbolic number knowledge as verbal subitizing, counting, numerical magnitude comparisons, linear representations of numbers, and arithmetic operations. Students that struggle early in mathematics usually have difficulties learning verbal and symbolic number knowledge as they progress due to the influence of experiences and instruction. Students from low-socioeconomic backgrounds often do not receive preschool experiences to assist in building verbal and symbolic number knowledge. In another study, Jordan et al. (2007) found that students from low-socioeconomic backgrounds entered kindergarten "well behind" (p. 36) students from middle-class backgrounds in tasks that assess number competence. Jordan and Levine (2009) propose that early interventions at home and school "have potential to help all children develop the foundations they need to learn school mathematics" (p. 65).

Chow (2007) initiated a four-year longitudinal study that analyzed the difference in achievement among students that were identified as receiving free lunches, receiving reduced-price lunches, and students ineligible for free or reduced lunches. The study found that there were no statistically significant differences across socioeconomic status. The study did acknowledge that there were small differences of practical significance in achievement. Students that did not receive free or reduced lunch scored with the highest mean, followed by students receiving reduced price lunch, and then students receiving free lunch. However, most students identified as receiving free lunch still passed the mathematics TAKS test. The study also found that there were not any growth rate differences across time. Scores were consistent providing evidence that students learn the same amount of information. The critical factor is where students start in relation to performance on standardized test after a period of instruction.

Culturally Responsive Pedagogy

There have been numerous discussions about the intersectionality of culture, learning, and the school experience. The contributions of Lev Vygotsky to sociocultural learning theory have paved a way for educational theorists to examine to what extent culture influences the education that an individual incurs. Vygotsky (1986) described learning “as being embedded within social events and occurring as a child interacts with people, objects, and events in the environment" (p. 287). A pedagogical approach that emphasizes sociocultural learning theory is culturally responsive pedagogy (Gay, 2000). Culturally responsive pedagogy (CRP) evolved from other pedagogies that emphasized the influence of culture in student’s learning. Some have describe these pedagogies as “culturally appropriate” (Au & Jordan, 1981), culturally compatible” (Jordan, 1985; Vogt, Jordan, & Tharp, 1987), “culturally congruent” (Irvine, 2003; Mohatt & Erickson, 1981), “culturally relevant pedagogy” (Ladson-Billings, 1994), and “cultural responsive” (Cazden & Leggett, 1981; Gay, 2000).

Culturally responsive teaching (Gay, 2000) and culturally relevant teaching (Ladson-Billings, 1994) are the most common terms used today to refer to this space of cultural pedagogical theory. Ladson-Billings coined the term “culturally relevant” in response to her research of identifying effective practices and qualities of highly effective teachers of African American students. According to Ladson-Billings (1995a), culturally relevant teaching is a pedagogy of opposition that is committed to collective empowerment that relies on three propositions: 1) students must experience academic success (p. 160); 2) students must develop and/or maintain cultural competence (p. 160); and 3) students must develop a critical consciousness through which they challenge the status quo of the current social order (p. 161).

The first is that students must experience academic success. Academic success is reliant on the development of academic skills such as literacy, numeracy, technological, social and political skills. Ladson-Billings states that these are the minimal necessary skills that students must develop “in order to be active participants in a democracy” (p. 160). Ladson-Billings stresses that “culturally relevant teaching requires that teachers attend to students’ academic needs, not merely make the ‘feel good’…the trick is to get students to ‘choose’ academic excellence” (p. 160).

The second criterion of culturally relevant teaching is that students must develop and/or maintain cultural competence (Ladson-Billings, 1995a). Ladson-Billings states that “culturally relevant teachers utilize students’ culture as a vehicle for learning” (p. 161). The school environment should not be a place where students cannot be themselves. Also, students must develop the skills of translation and code switching.

The third criterion of culturally relevant teaching is that students must develop a critical consciousness through which they challenge the status quo of the current social order (Ladson-Billings, 1995a). Students must be able to move beyond just choosing academic excellence and being culturally aware and competent. It is important for students do develop a “sociopolitical consciousness that allows them to critique the cultural norms, values, mores, and institutions that produce and maintain social inequalities” (p. 162). Teachers must help students construct knowledge of local,

national, and global issues. Culturally relevant teachers assist students in developing the critical thinking and critical examination skills to empower students with the ability to actively critique and challenge sociocultural norms.

Gay (2000) takes culturally relevant teaching into more extensive depths and utilizes the term culturally responsive pedagogy (CRP). Gay's framework is a product of researched based practices and sociocultural approaches to education. Gay (2000) defines CRP "as using the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant and effective for them" (p. 29). Gay identifies culturally responsive teaching as being comprehensive, multidimensional, empowering, transformative, as well as emancipatory. Gay's framework of culturally responsive teaching has four critical parameters: 1) caring; 2) communication; 3) curriculum; 4) and instruction.

Caring includes the personal, social, and ethical dimensions of teacher-student interactions (Gay, 2000, p. xv). Caring moves beyond the simplistic forms of kindness, gentleness, and benevolence toward the "dimensions of emotion, intellect, faith, ethics, action, and accountability" (p. 48). A caring teacher has high expectations and values accountability and holds students accountable to their high expectations, always expecting the student's best. CRP relies heavily on the importance of communication. Teachers must learn how to effectively communicate (verbally and non-verbally) with their students. Gay suggests that "aligning instruction to the cultural communication styles of different ethnic groups can improve school achievement" (p. xvi). Another critical parameter of CRP is curriculum. Gay states that "the fundamental aim of culturally responsive pedagogy is to empower ethnically diverse students through academic success, cultural affiliation, and personal efficacy" (p. 111). It is critical to align the curriculum with the inclusive culture of the students and community. Students must be able to connect knowledge to their lives and experience both inside and outside of school.

The fourth critical parameter is instruction. CRP desires to move away from cultural mismatch and toward a curriculum that is "culturally congruent" (xvii) with the students in the specific educational setting. To accomplish this goal, teachers must not only have a curriculum that is congruent with the cultural environment of the classroom, but also must be able to identify and understand the various "procedural, communicative, substantive, environmental, organizational, perceptual, relational, and motivational stimulation preferences" (p.151) of their students. A culturally responsive teacher must be able to modify and adapt instruction to meet the various learning styles and processes of students.

Culturally responsive pedagogy is a dynamic, multifaceted framework that centralizes culture in the educational environment. Culturally responsive teachers are culturally competent, culturally sensitive, and caring. Culturally responsive teachers assist students in their educational journey by helping them develop the critical consciousness to question and challenge the status quo. They also examine the curriculum and instructional practices for bias and cultural mismatch. A culturally

responsive teacher is *responsive* to the needs of the students, community, and global societal and environmental population.

Methodology

This study critically examined TAKS mathematics data through the guiding research question: What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by socioeconomic status? This study used descriptive statistics to describe the differences in TAKS mathematic assessment data across socioeconomic status from TAKS 2004, 2007, and 2010 data. The population for this research study was students from grades three through eight who took the 2004 (N = 1,691,828), 2007 (N = 1,769,783), and 2010 (N = 1,982,189) TAKS mathematics test. The population is categorized by the economic situation of the student's guardians. The categories include *free meals*, *reduced meals*, *other*, or *no*.

The Texas Assessment of Knowledge and Skills (TAKS) mathematics test was the instrument used for this research study. The data used for this research study were Texas TAKS archived data. Archived quantitative data were analyzed using the statistical software *Statistical Package for Social Studies* (SPSS) 16.0 Graduate Pack. A series of one-way Analysis of Variance (ANOVA) trials were performed to determine relationship and significance ($p < .05$) between groups and within groups. To determine the location of specific significant differences, Bonferroni *post hoc* procedures were performed. This study explored both practical and statistical significance in attempt to identify differences between groups.

Findings

Mean scores were critically examined across objectives by socioeconomic identifiers through performing a series of one-way ANOVAs ($p < .05$) to answer the following guiding research question: What are the differences in TAKS scores of students in grades three through eight during the years 2004, 2007, and 2010 by mathematical objective categorized by socioeconomic status? Statistical significance was observed across several grades among groups (see Table 1), but statistical significance was not found within groups. Bonferroni *post hoc* tests were performed to identify specifically where significant differences were located.

Objective 1

Statistically significant differences were most common between students' identified as not economically disadvantaged and students' receiving free meals. Significant differences for objective one (numbers, operations, and quantitative reasoning) were observed between students' identified as not economically disadvantaged ($M = 8.63$) and students receiving free meals ($M = 7.73$, $p = .028$) in grade three. Similar differences remained in grade four with students' identified as not economically disadvantaged ($M = 9.77$) scoring higher than students' receiving free meals ($M = 8.93$, $p = .045$). No statistically significant differences were observed in grades five through eight for objective one.

Objective 2

Significant differences across objective two (patterns, relationships, and algebraic reasoning) were only observed in grades three and eight. In grade three, students' identified as not economically disadvantaged (M = 5.16) mean score was significantly higher than students' receiving free meals (M = 4.73, p = .037). In grade eight, students' identified as not economically disadvantaged (M = 7.57) mean score was higher than students' receiving free meals (M = 6.37, p = .031) and higher than students' identified as other economically disadvantaged (M = 6.43, p = .042).

Objective 3

Statistically significant differences were also prevalent in objective three (geometry and spatial reasoning) in grade three and grade five. Statistically significant differences were not present in grades four, six, seven, and eight. Students' paying a reduced fee for meals (M= 5.07) mean score was higher than students' receiving free meals (M = 4.87, p = .017) in grade three. Also in grade three, students' identified as not economically disadvantaged (M = 5.27) mean score was significantly higher than students' receiving free meals (M = 4.87, p < .001), students' paying a reduced fee for meals (M = 5.07, p = .017), and students' identified as other economically disadvantaged (M = 4.97, p < .001). In grade five, the only difference of statistical significance was between students' identified as not economically disadvantaged (M = 6.27) and students' receiving free meals (M = 5.77, p = .019).

Objective 4

The only significant differences across objective four (measurement) were in grade seven. Students' identified as not economically disadvantaged (M= 3.47) mean scores were higher than those of students' receiving free meals (M = 2.70, p = .015) and students' identified as other economically disadvantaged (M = 2.70, p = .015).

Objective 5

Statistically significant differences were observed in grades three and five for objective five (probability and statistics), but not in grades four, six, seven, and eight. The most noticeable differences occurred in grade three where students' identified as not economically disadvantaged (M = 3.60) mean scores were higher than students' receiving free meals (M = 3.33, p < .001), students' paying a reduced fee for meals (M = 3.40, p = .002), and students' identified as other economically disadvantaged (M = 3.33, p < .001). Statistically significant differences were not observed in grades four and six through eight.

Objective 6

The objective with the most occurrences of statistical difference among objective means was objective six (mathematical processes and tools). In the third grade, students' paying a reduced fee for meals (M = 5.57) scored higher than students' receiving free meals (M = 5.17, p = .036) and higher than students' identified as other economically disadvantaged (M = 5.13, p = .023). Also in the third grade, students' identified as not economically disadvantaged (M = 6.20) mean scores were significantly higher than all other groups. In grades four through six, the mean scores of students' identified as not economically disadvantaged were significantly higher than students' receiving free meals and students' identified as other economically disadvantaged. In grade seven, significant differences were present between students' identified as not economically disadvantaged (M = 7.03) and students receiving free meals (M = 6.00, p = .027). Grade eight was the only grade that significant differences were not observed for objective six (mathematical processes and tools).

Within Group

There were no statistically significant differences within groups. Within group data were also explored across 2004, 2007, and 2010 by objective and socioeconomic status to identify differences and themes of practical significance. Students across all groups scored higher on objective one (numbers, operations, and quantitative reasoning) in grades three through five than in grades six through eight. Students across all groups also scored slightly lower on objective four (measurement) in grades seven and eight than in grades three through six. In most instances, groups mean scores improved between years within each objective. However, there was a common trend within objective six (mathematical processes and tools). Students in all groups saw a slight decrease in objective six mean scores between 2007 and 2010 in at least one grade level.

Discussion

The objective of this study was to identify any differences that may occur on the TAKS mathematics assessments in grades three through eight in 2004, 2007, and 2010 between students from various socioeconomic situations. This study also examined within group data to identify performance differences across years and objectives. Statistical significance was determined by performing one-way ANOVAs ($p < .05$). Statistical significance was observed between certain groups, but not within any group.

One-way ANOVA results identified that significant differences occurred between students' identified as not economically disadvantaged and all other students at various grades and across various objectives. The only other occurrences of significantly higher scores were between students' receiving reduced meals and students' identified as other economically disadvantaged. The Bonferroni *post hoc* tests identified the location of statistical significance in mean scores by objective across socioeconomic identifiers. The most frequent instances of statistical significance were across all objectives except objective four (measurement) in grade three and across objective six (mathematical processes and tools) in grades three through seven. The highest number of quantifiable

differences occurred between the mean scores of students' identified as not economically disadvantaged scoring significantly higher on objective means than students' receiving free meals or identified as other economically disadvantaged. After students' move beyond the third grade, the number of statistically significant differences drastically reduces. By the eighth grade, statistical differences are difficult to locate.

Further exploration of within group data identified several themes that were prevalent among all groups. All four groups seemed to score higher in grades three through five on objective one (numbers, operations, and quantitative reasoning) than in grades six through eight. Student mean scores on objective four (measurement) tended to reduce in the seventh and eighth grades. Each group also experienced a slight decrease between 2007 and 2010 on objective six (mathematical processes and tools) across at least one grade level. Students' identified as not economically disadvantaged scored at-least slightly higher than all other groups across all objectives in 2004, 2007, and 2010. Culturally responsive pedagogy is a viable option to eradicate the differences in mean scores observed across all objectives.

The following three sub-sections provide suggestions to respond to the findings in this study. The first section is *Preparing the Middle Level Mathematics Facilitator*, which suggests that middle level mathematics education and professional development programs should focus on culturally responsive mathematics pedagogy to develop highly effective middle level mathematics facilitators. The second section is *Socioeconomic Status and the Classroom Environment*, which provides suggestions to improve the educational experience of students from financially oppressed situations. The third and final section discusses *Transitioning to the State of Texas Assessments of Academic Readiness (STAAR)*, which identifies a issue of concern between the middle level TAKS and the middle level STAAR assessment.

Preparing the Middle Level Mathematics Facilitator

Whether it is through teacher education programs or professional development, educators must work to develop highly effective middle level mathematics facilitators. The Association for Middle Level Education (AMLE) provided a position statement highlighting 16 characteristics of successful middle grades schools. Some of the key ideas from those identified characteristics were responsiveness, challenging, empowering, and equity (Strahan & Rogers, 2012). According to the position statement, educators should: value young adolescents, engage in active learning, provide a challenging curriculum, provide multiple approaches to teaching and learning, and provide varied and ongoing assessments. Culturally responsive pedagogy provides a means to address each of the aforementioned characteristics of successful middle grades schools.

The idea of culturally responsiveness seems to be appreciated by many, but how do we develop culturally responsive mathematics facilitators? Gay (2000) provides a framework that emphasizes caring, communication, curriculum, and instruction. Mathematics education should begin with focusing on ideological and *historicity* (Freire, 1971) to create a foundation for Gay's framework. "Ideology can best be understood as a societal lens or framework of thought, used in society to create order and give

meaning to the social and political world in which we live" (Darder, Baltodano, & Torres, 2009, p. 11). To accomplish this, mathematics educators should be encouraged to enter reflective space exploring current and historical influence to develop an understanding of their ideology and the impact of their ideology. Suggested activities to support exploration of ideology are: mathematical autobiographies, reading or discussion reaction statements, and participation in activities that examine power and privilege (Leonard, 2008). Activities such as these provide a pathway for mathematics facilitators to further connect with their *ethic of care* (Noddings, 2003), which includes the personal, social, and ethical dimensions of participatory interactions (Gay, 2000).

A caring mathematics facilitator will seek to develop effective communication skills with students and families from various cultural environments. Mathematics education should provide access to language acquisition for any language spoken in a specific context and strategies to work with students using languages other than that of the mathematics educator (Kersaint, Thompson, & Petkova, 2009). Mathematics education should also assist in training teachers to be knowledgeable of common verbal and non-verbal communication methods of their students. This may include analogies, facial expressions, lyrics, metaphors, and/or similes (Gay, 2000). A caring teacher will take caution with making assumptions about physical expressions.

Once mathematics educators develop the skills of effective communication and identifying power structures, they can work to create a culturally responsive curriculum. The key curriculum elements of culturally responsive pedagogy include: personal experiences from students' lives; role models; culturally grounded stories, songs, photos, or other ways of expressing community values and beliefs; language and linguistic expressions; multiple perspectives on issues, themes, and/or problems; formal and traditional content; and social issues (Gay, 2000; Ladson-Billings, 1994; Leonard, 2008; Pang, 2005). Creating opportunities for mathematics educators to partake in actual curriculum research and development would assist in developing the skills necessary to create culturally responsive curriculums. In the standards-based era with strict curricular expectations and limited teacher input, one may want to recall Freire (1971) response to pressures of conformity to create counterhegemonic alternatives for students. Freire emphasizes the need to gain a "strong command of one's particular academic discipline…[and] engage critically classroom content, from their existing knowledge and the events and experiences that comprise their living history" (Darder, Baltodano, & Torres, 2009, p. 13). Once a mathematics facilitator has a strong command of the mandated mathematics curriculum they are able to create a social space to use mathematics as a tool to challenge the current social order.

The fourth tenet of Gay's (2000) framework is instruction. A caring mathematics facilitator that has a strong connection with the culture, curriculum, and social issues is primed to participate in culturally responsive mathematics instruction. Facilitating mathematics lessons that are culturally responsive to current and future teachers could inspire ideas for future lessons. Mathematics educators may want to encourage current and future mathematics teachers to think local, national, and international when creating mathematics lessons. This will allow for a contextualized instructional approach to mathematics. Beyond providing visual examples of culturally responsive mathematics

instruction, mathematics educators should provide mentorship to mathematics facilitators through lesson development, instructional feedback, instructional resources, and general dialogue. Mentorship will assist facilitators in their growth as a culturally responsive mathematics facilitator. Another instructional recommendation is to move beyond the idea and limitations of "problem solving" (Polya, 1945) to a more advanced "problem posing" (Freire, 1971). Focusing instruction around problem posing will assist teachers and students in developing mathematical literacy to navigate social systems.

Socioeconomic Status and the Classroom Environment

The previous section provided a argument that culturally responsive mathematics pedagogy could be a means to improve the academic experience of students. Culturally responsive pedagogy is an individualized approach to education. However, there are situations where the complexity of culture is minimized and becomes a tool for oppression. For example, you may have witnessed reference to a 'culture of poverty', which has been a focus of Ruby Payne's approach to addressing 'poverty' in education. Delpit (2012) reminds us that "what Payne is labeling culture is actually the response to oppression" (p. 7).

How can mathematics educators address difference in performance across socioeconomic variables? Through the use of culturally responsive mathematics pedagogy, facilitators can use mathematics as a tool to address oppression due to the economic structure. One approach is to magnify counter-narratives to the dominant deficit ideology associated with people from financially oppressed groups. Gorski (2011) provides insight to defeating deficit ideology by "learning to 'spot it', reflect critically upon your own class socialization, refuse to locate problems in the 'cultures' of disenfranchised groups, and [we] must teach about economic injustice and poverty" (p. 167-169). Mathematics educators can develop culturally responsive lessons that focus the critical social issue or economic injustice by drawing attention to social support systems, financial poverty, minimum wage, living wage, property rights, gentrification, and taxation. Swalwell and Gorski (2012) suggest educators to take a resilience approach that is guided by high expectations and empathy. They provide a list of suggestions for educators that is supported by research to have a positive impact on students from oppressed socioeconomic situations:

- Nurture relationships with community organizations (Neuman, 2009);
- Reduce class sizes (Rouse & Barrow, 2006);
- Extend vision screenings to include farsightedness (Gould, 2003);
- Make early childhood education universal and universally high-quality (Feeney, Freeman, & Pizzolongo 2010);
- Examine learning materials for bias – picture books often are particularly class-biased (Mendoza & Reese, 2001);

- Promote reading enjoyment and minimize the extent to which students have to "perform" their literary skills publicly;
- To defend and integrate arts and music (Pogrow, 2006);
- Dress humbly – students from low-income situations struggled to fit in school because of the inability to afford the newest fashions (Brann-Barrett, 2010);
- Express high expectations (Howard 2007);
- Parent outreach (Howard 2007);
- Peer tutoring (Maheady, Mallette, & Harper, 2006);
- Make involvement accessible;
- Never assume access to materials (Gorski, 2009);
- Cooperative learning (Slavin, Lake, & Groff, 2009);
- Teach about poverty (Chafel, 1997);
- Build trust (Hughes, Newkirk, & Stehnhgem, 2010);

Many of the suggestions provided by Swalwell and Gorski are difficult to achieve due to excessive budget cuts. Mathematics educators should organize to challenge deep budget cuts and to advocate for a more equitable educational experience for middle level students. However, many suggestions are without limitations. Having high expectations, taking a caring-centered approach, reaching out and communicating with parents, utilizing cooperative learning, building trust, and teaching about poverty are all within reach for culturally responsive middle level mathematics educators. Dressing humbly can reduce social stress for students (Brann-Barrett, 2010) and inherently positions the facilitator in a social space challenging hegemony associated with 'professional' dress. A caring facilitator can dress desirable without perpetuating ageism, classism, racism, and sexism. Each suggestion provided is supported by research and supported by the position statement of AMLE.

Closing Remarks

The results of this study affirm that the influence of socioeconomic variables heavily influence students' performance on the TAKS mathematics test. Students' identified as not economically disadvantaged scored significantly higher than students' receiving free meals in the third grade during each testing year. Even though the number of statistically significant differences reduces after the third grade, students' identified as not economically disadvantaged mean scores were higher than all other groups across all grade levels and objectives. The objective with the most occurrences of statistical difference among objective means was objective six (mathematical processes and tools). This poses a severe concern as Texas moves from TAKS to STAAR. STAAR is

expected to be more rigorous and is expected to focus more heavily on readiness standards. In doing so, Texas has decided to remove objective six (mathematical processes and tools) as a stand-alone objective. The former objective six is now embedded throughout the new objectives one through five. Students across race/ethnicity (Fox, 2012), gender (Fox & Larke, 2013), and socioeconomic status have scored lower on objective six (mathematical processes and tools). Stakeholders attempting to identify students' strengths and weaknesses will incur a new challenge when examining students' data across mathematical objectives. It is suggested that future studies explore the *intersectionality* of performance data. Further studies are desired to explore why there are specific differences between groups within objectives.

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Appendix A

Table 1. One-way ANOVA Results Between Groups by Socioeconomic Status

Grade	Objective	F	p-value
3	1	F(3, 8) = 6.06	p = .019*
	2	F(3, 8) = 4.96	p = .031*
	3	F(3, 8) = 26.25	p < .001***
	4	F(3, 8) = 4.23	p = .046*
	5	F(3, 8) = 28.67	p < .001***
	6	F(3, 8) = 42.22	p < .001***
4	1	F(3, 8) = 5.05	p = .030*
	2	F(3, 8) = 3.50	p = .069
	3	F(3, 8) = 4.07	p = .050
	4	F(3, 8) = 2.03	p = .188
	5	F(3, 8) = 2.06	p = .184
	6	F(3, 8) = 7.84	p = .009**
5	1	F(3, 8) = 2.41	p = .142
	2	F(3, 8) = 3.80	p = .058
	3	F(3, 8) = 6.21	p = .017*
	4	F(3, 8) = 3.63	p = .064
	5	F(3, 8) = 4.84	p = .033*
	6	F(3, 8) = 9.05	p = .006**
6	1	F(3, 8) = 3.05	p = .092
	2	F(3, 8) = 1.73	p = .238
	3	F(3, 8) = 2.17	p = .170
	4	F(3, 8) = 1.64	p = .256

	5	**F(3, 8) = 5.09**	**p = .029***
	6	**F(3, 8) = 8.30**	**p = .008****
7	**1**	**F(3, 8) = 2.90**	**p = .102**
	2	**F(3, 8) = 2.27**	**p = .157**
	3	**F(3, 8) = 2.05**	**p = .186**
	4	**F(3, 8) = 8.49**	**p = .007****
	5	**F(3, 8) = 0.83**	**p = .511**
	6	**F(3, 8) = 6.40**	**p = .016***
8	**1**	**F(3, 8) = 6.06**	**p = .190**
	2	**F(3, 8) = 4.96**	**p = .018***
	3	**F(3, 8) = 26.25**	**p = .048***
	4	**F(3, 8) = 4.23**	**p = .196**
	5	**F(3, 8) = 28.67**	**p = .138**
	6	**F(3, 8) = 42.22**	**p = .040***

Note: **This table addresses statistical significance at $p < 0.05$: *$p < 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$.**

Trust Me on This

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Abstract

Successful completion of Algebra I is essential for all students in the United States, and is a high-stakes, gatekeeper course. However, a substantial proportion of students from marginalized groups do not gain access to Algebra I until much later in their academic careers than their middle-class, White, English-speaking, fully able peers. This is not only an issue of tracking individual students, but is also indicative of a more profound, institutionalized set of practices. Using a purposive sample, this research highlights the ways middle school mathematics teachers make tracking and student-placement decisions. Teachers in this qualitative research (n=10) reported a heavy reliance on their own omniscience.

Introduction

Is our professional practice as teachers an art, or a science? Is it perhaps some mysterious mix or combination of the two? In what ways might this alchemy have life-long effects upon our students? In this research, I explore this tension between "gut feelings" about a key educational decision and the influence of data in making recommendations related to when middle-level students take Algebra I.

Successful completion Algebra I is of growing importance in the trajectory of any student's school career, as well as in life beyond K-12 education. Within the U.S. mathematics education community, Algebra I is well understood to be a gatekeeper course, in that successful completion of Algebra I is essential for success in adulthood (National Council of Teachers of Mathematics, 1998). This applies not only to students seeking entrance to college (as in the past), but is also true for any high school graduates who wish to enter the workforce (American College Test, 2006). Algebra is not only the foundation for all further study of mathematics, but also an excellent proving ground for abstract thinking and reasoning, skills that are of value in nearly every facet of life.

Access to algebra has even been labeled a civil rights issue. As Moses and Cobb (2001) explained, "…The most urgent social issue affecting poor people and people of color is economic access. In today's world, economic access and full citizenship depend crucially on math and science literacy" (p. 5). They went on to say, "…People who don't have it [successful completion of Algebra I] are like the people who couldn't read and write in the industrial age" (p. 14). The past president of the National Council of Teachers of Mathematics, Cathy Seeley, built on this idea in one of her newsletters:

"Expecting all students to complete four years of high school mathematics that begins with this gatekeeper course [Algebra] is not only a good idea, but is also our moral and ethical responsibility" (2005, p. 2). Therefore, for school administrators and teachers to counsel students of color, English language learners, students who qualify for free and reduced-price meals, and students identified with learning disabilities away from this goal is to deny them the access to the lifetime of opportunities afforded to middle-class, White, able, heritage speakers of English. This situation further reproduces existing social stratifications in U.S. culture.

In tandem with this rise in the importance of successful completion of Algebra I is the issue of shifting demographics in the United States. The composition of the population of the United States is changing, and this is reflected in our schools. As the National Center for Education Statistics (NCES; 2007a), confirmed, "The U.S. population has become more diverse over the past two decades as minority population groups have increased more rapidly than the White population" (p. 1). Further, the same NCES report stated that, as of 1999, Latinos surpassed African Americans as the largest minority group in the United States, with the U.S. Latino population increasing 192% between 1980 and 2005. During the same 25-year span, the White population in the United States increased by only 10%, and the African American population grew by 39%. The NCES (2007b) predicts the minority population of the U.S. will continue to grow and will increase an additional 32% by the year 2020.

Methodology

We know that some students may enter Algebra I as early as grade 5, while others may not gain access until 9th or 10th grade, and we know that those entering earliest tend to be White, English-speaking, and generally privileged. So this brings us to the question: How are decisions being made as to which students may proceed into Algebra 1, and at what points in their academic careers? What primary tools or criteria are being used to make these life-impacting decisions? These questions lie at the center of this study, and in an effort to begin to articulate some of the nuances around it, I interviewed 10 middle school mathematics teachers, employed in a large, urban public school system, who were involved in making mathematics course placement recommendations (and/ or decisions) for the middle school students in their schools. This research focuses on the ways these teachers explain, defend, and justify their decisions. For the purposes of this article, all names and locations have been fictionalized, and I have limited my description to just three participants.

The Primary Finding: Omniscience or "A gut feeling"

Again, how do the middle school mathematics teachers in this study view their own roles in the process of educating students? All teachers in this research (10 middle-school mathematics teachers) expressed commitment to their students and their professions, and most (8 of 10) expressed a profound desire to continue to learn and grow. However, the most frequently occurring pronounced theme expressed by the secondary mathematics teachers who participated in this study was one of being "all knowing"—or in other words, omniscience. Although seven of the informants suggested that they were "just" teachers, using language to humble themselves, nine chose to

assert their personal senses of enlightened wisdom, awareness, and complete understanding of the students in their care. With varying degrees of concern and regard, participants with this stance of omniscience expressed confidence in their personal, subjective evaluations of each student. As Tyack and Hasnot (as cited in Brantlinger, 2003) suggested, "A tacit consensus exists among educators, scholars, and elites that only expert knowledge is legitimate" (p. 10).

This common theme of omniscience, which includes the shifting of focus away from students outside the mainstream, is not necessarily indicative of inherently weak, unskilled, uncaring, or unsuccessful teachers. Rather, those educators espousing an omniscient perspective believe they are acting in ways that benefit the learners in their care, and see themselves as doing what is in the best interests of each learner. Through their individual cultural conditioning and the development of their unique perspectives on education (shaped by their individual life experiences as White English speakers), those teachers with an omniscient sense believe they are acting as advocates rather than as oppressors. In writing about teachers who hold limited or limiting beliefs about their students, Delpit (1995) pointed out that these educators "probably are not bad people. They do not wish to damage children; indeed, they likely see themselves as wanting to help. Yet they are totally unable to perceive those different from themselves except through their own culturally clouded vision" (p. xxiv).

I posit that omniscience, when exercised by middle schools mathematics teachers who abide by the traditional teaching philosophy of making course placement recommendations for their students, may be considered a form of symbolic violence (Bourdieu, 1991) when teachers place students into the lowest mathematics tracks available. In relying upon a sense of omniscience, secondary mathematics teachers, with their positions of power, use this authority to change the educational paths (and by extension, change the lives) of their students.

For several of the middle school mathematics educators in this study, the idea that particular students—students from outside the mainstream—should be in more advanced mathematics classes was an idea that was viewed as "seemingly irreconcilable." Bruner (1990) made connections to this idea of omniscience in his discussion of the ways narratives within cultures are constructed. He stated, "An obvious premise of our folk psychology … is that people have beliefs and desires: we *believe* that the world is organized in certain ways, that we *want* certain things, that some things *matter* more than others, and so on" (p. 39). Building on this idea, he went on to posit, "We believe, moreover, that our beliefs should cohere in some way, that people should not believe (or want) seemingly irreconcilable things" (p. 39). In this way, participants worked to "preserve the core"—that is, they worked to maintain the status quo by keeping students the least privileged statuses (students of color, English learners, students receiving special education services) in the lowest level mathematics courses.

In developing these omniscient teaching views, participants typically expounded at length about examples of their views of what they considered "normal" students—that is, students fitting into the mainstream majority--sometimes including their own

biological children. For example, their stories frequently began with words like, “this one student” or “my daughter” or “this really bright kid.” These stories fit into what Bruner (1990) described as the way “human beings, in interacting with one another, form a sense of the canonical and ordinary as a background against which to interpret and give narrative meaning to breaches in and deviations from ‘normal’ states of the human condition” (p. 67). These stories of “normal” students emerged as participants were asked about students from outside the mainstream. It was challenging to keep the focus on marginalized students, because the participants tended to shift the conversation back to descriptions and tales of “normal” students.

The nine secondary mathematics teachers in this study who expressed a sense of omniscience assigned power for all decision making with themselves or with other school-based teachers. The omniscient beliefs of traditional middle school mathematics teachers seem to lead them to believe they were able to see and evaluate situations from an objective standpoint, as the situations truly exist, with no admission or acknowledgement of other ways of seeing, knowing, or believing. This stance is most typified by educators with an unwavering sense of certainty in their own opinions about students—with the attitude that these opinions were, in fact, facts.

The middle school mathematics teachers in this study expressed, described, and qualified their omniscient teaching philosophies and views in several ways, two of which I will describe here: (a) the “gut feeling”; (b) idiosyncratic and unwritten “rules” for students.

The Omniscient’s “Gut Feeling”

Nine of ten participants, using assertive language and convincing tone, explicitly expressed that they experienced or knew of other teachers who had a “gut feeling” or a sense “in [their] heart” about which mathematics courses were most appropriate for each student and which students were best suited for each course. These participants strongly believed that their intuition and professional background qualified them to make these critical student placement decisions without needing to see test scores or grades.

When explaining their thinking using these idioms, the mathematics teachers in this study frequently supplemented their assertions with body language by pressing their abdomens when mentioning a gut feeling, or tapping their chests when speaking of a sense in their hearts. However, when expressing this intuitive form of knowing, this bodily omniscience, participants rarely offered quantifiable evidence to support their assertions. The simple act of “intuitive knowledge,” buoyed by each individual’s position of power as a teacher, was offered as enough of a solid basis for making course and placement recommendations, and it did not require additional documentation, evidence, or proof. The existence of this allegedly keen intuition was sufficient evidence for participants to speak with great conviction about which courses were most appropriate for each student.

Randall. The participant most strongly expressing omniscience through a “gut feeling” was Randall. After several decades of working in a field unrelated to education, Randall earned a Master of Science in education and entered the teaching profession

relatively late in life. At the time of these interviews, Randall had been a middle school mathematics teacher for eight years.

Randall's strong conviction that his own ideas and intuitions about student course recommendations were right and correct was the most extreme among the participants in this research. He strongly emphasized his use of student assessment and grading during our conversations. In addition, as supporting evidence to his commitment to just and objective teaching, he commented that he had developed an innovative grading system that is both "accurate" and "fair." In discussing the grading system, he also expressed, at great length, how much his own grading is based on what he referred to as an intuitive "understanding" of his students. Randall summed it up by saying, "You just *know*," and expanded this sentiment further in stating, "I know the students better than any test can tell." As it turned out, those recommended by Randall to proceed to Algebra I were disproportionately White and monolingual-English.

This perspective, this idea that "you just know" what is "best" for students, is echoed in the work of Brantlinger (2003), when discussing how those with elevated status (i.e., those with historically privileged identities, like teachers) construct "ideological tales" to mask or "divert attention" from their own complicit roles in maintaining institutionalized hierarchies. Brantlinger stated, "Subordinates are not asked how they feel about segregated or lesser status nor are they seriously included in decisions that affect them. It is implied that remedies benefit them or the whole society" (p. 9).

Randall, with his strong reliance on his gut feeling, frequently linked his impressions of observed classroom behavior to his beliefs on the students' academic readiness for more difficult course work. In talking about his decision-making process in making course recommendations for students, Randall said,

> I'm also, in the back of my mind, thinking behavior as part of that, attendance as part of that, and ah, that's … that's … ah … where it's more of an art than a science. But, ah, if I know I have a kid that's screwing around in class and doesn't get his homework done ….

This trailing off, which was followed by a shrug, was a strong statement about the unbreakable link, to Randall, between his interpretation of student behavior and readiness for academic challenges. In his thinking, activities considered to be "screwing around," (meaning "to waste time") were not afforded careful scrutiny, and failure to complete homework was not probed, but rather simply taken as sufficient evidence of lower ability or deserving of few opportunities. Randall's personal, intuitive, gut feeling led the way.

Christine. Like Randall, Christine also followed her "omniscient gut feeling" in making crucial placement recommendations for her students. When asked about how she makes her course placement recommendations, Christine offered this example, wherein she described a student's reaction to getting a poor grade. Christine explained that she offered all students an opportunity to do "test corrections." This means that

after each test, the students may choose to review their errors and make corrections for partial credit. She said,

> A kid who does test corrections is saying, "Hey, I have some incentive to do better. I can still improve." Whereas a kid who sees that grade and says, "I'm done!" may, so… It's sort of those kinds of things, and that's, sort of the gut instinct that, that goes into it a lot of times. It's, you know.

Christine took this willingness to complete test corrections at face value and did not probe further into why a student may or may not have chosen to participate. No acknowledgement of other factors (fatigue, frustration, lack of interest, distraction, etc.) that might cause students to avoid or decline participation in test corrections was mentioned.

Christine built on this initial example, explaining how she incorporated it (and similar anecdotal examples) into making mathematics course recommendations for her students. She explained, "I almost can't even say, for some kids, why I make the decision. I just, when I think about them, I say, 'Yeah, that's somebody who should be going to Algebra.'" Similar to Randall, the students she recommended for Algebra I were disproportionately White and monolingual-English speaking.

Taking this "omniscient gut feeling" further, Christine explained that when considering students for promotion to the more advanced levels of mathematics, she strongly considers,

> ..their interest in math and so that, that I think probably really sort of plays into the gut instinct. You know, there are kids who get excited; like the other day, we were doing angle relationships, and there were kids who looked at the two parallel lines cut by a transversal, and they were all excited about the fact that it was really a puzzle, you know? So I look at those kinds of activities, you know? Does this kid get excited about that, or are they like, "Oh, really? When am I gonna be done?"

Here, Christine seems to equate her perception of enthusiasm for the subject matter with a readiness for further study. Because she is a mathematician, perhaps she places additional value on students who express a similar eagerness for the content. Those students who express apparent boredom, disinterest, or a lackadaisical attitude are not considered ready for promotion, regardless of their demonstrated mastery of the content.

Idiosyncratic and Unwritten "Rules"

Another common theme emerged among the participants in the study, which was reference to a privileged style of discourse and a preferential way of "being." Although each participant had a unique way of describing this, it was clearly the same general idea in each case, with those students deemed "not worthy" for promotion to be riddled with various undesirable characteristics, sometimes labeled as "attitude." The middle school mathematics teachers in this study who expressed this form of omniscient thinking had a defined "good" and "bad" list of attributes, characteristics, and "objective"

indicators in mind, which, although consistent among all participants, were neither stated nor included in any school district policies or formal documents. In this way, using arbitrary, idiosyncratic, and unwritten "rules," these educators expressing these perspectives used their positions of power in what could be described as tools of oppression. As Eagleton (as cited in Brantlinger, 2003) pointed out, "It is the oppressor's privilege to decide what the oppressed should be" (p. 11).

Delpit (1995) has voiced perspectives on this idea, too, with regard to a privileged "way" of participating in the culture of power. She stated, "The rules of the culture of power are a reflection of the rules of the culture of those who have power" (p. 25). She continued, "This means that success in institutions—schools, workplaces, and so on—is predicated upon acquisition of the culture of those who are in power" (p. 25). These meshes neatly with the narratives constructed by the participants, who, in sum, said to students: Be like me.

Scott. Although Scott did not explicitly embrace or espouse the idea of omniscience, he indicated that he had a clear understanding of how an educator who espoused an omniscient philosophy could lend itself neatly to an idealized style of discourse or a preferred way of being among teachers. Although he did not use the words "omniscience" or "symbolic violence," Scott described some ways secondary mathematics teachers enacted these ideas by, for example, retaining students simply because, in their opinion, these students either did not have or did not display the "preferred characteristics" of being able to learn or communicate in a certain way.

I asked Scott why teachers would want to hold students back or why they would want to limit opportunities for their students, and he explained that among teachers in his school district,

There are some long-held beliefs that some students aren't ready for certain courses, even if they want to take them. They're not cognitively ready, um, that they ha-, haven't matured enough to reach such a high level of mathematics at that point.

I asked, "Do you think that's true?"

Scott continued, "And that they need more time. I don't. I do not. I think that, given the right situation and a teacher who understands different ways that students learn, any student can progress, and can reach a challenge."

In continuing the conversation with Scott, I shared that some mathematics classroom teachers participating in this study had indicated that student behavior was a key factor in deciding whether to promote or slow down the progress of students. Scott replied,

> You know, I think that's a perfect example of what I was just talking about. They're making decisions based on, I think, very faulty logic. A student may be disruptive and a behavior problem because they are bored, and if they got into a class where they were learning new material at a faster pace, many of those things would disappear. Or maybe if they were with a teacher who created a relationship with them, or could see past the occasional acting out, and understood that they

> are eighth-graders, and they still have qualities of children, they could be very successful.

Scott built on this idea, giving an example from his own experience as a classroom teacher:

> So, I think that's, you know, I, just in my own experience, the thing that I would hate the most is the teachers at the first day of school who would grab your class lists and say, "Oh, this one, oh he's a pain in the neck. Oh, she's terrible, she just, she, she just wants to sleep all the time." Don't—no. Don't tell me those things, 'cause they're probably not true. They might be true; they might have been true in your class, but I doubt I'm gonna have those issue in my class. Oftentimes the students that I would have the more difficulty being with would be, uh, in my classes, would be the ones who were very compliant and who were very quiet, who thought that they could just, as long as they stayed quiet, and compliant, then they would make it through somehow. Those are the ones that I would tend to disrupt and shake them up a little bit so that they would push themselves to achieve higher.

Unlike Christine and Randall, Scott promoted students to Algebra I in proportions that reflected the overall population of the school, with students of color and English learners appropriately represented.

Randall. Although the majority of participants, when speaking about their students, were careful in choosing their words, and seemed to exert great effort to avoid using language or sharing ideas that could be construed as biased in any way, Randall offered a different view. When asked for his thoughts as to why the highest tracks were primarily composed of White and Asian students, Randall replied,

> How do you go about educating a student who will refuse to do all the work? And who will not listen to what's going on in class? You know, that is the age-old question—how do you educate them? I don't know. Well, it, but, I mean, there is, there is a secret code. It, if they do what White middle upper class and Asian students will do, chances are they will do much better in school! But if they are don't do it, or incapable of doing that, then, then it becomes a problem in the school. Um, and, how to get around that, I don't know.

What Randall expressed in this conversation was that for him, there is something that could be described as a "secret code," and in his thinking, this secret code is something students must learn, which involves learning to "act White." To paraphrase Randall, he said that if students would just learn to "act White," then they would be successful in his class. This blatant assimilationist agenda falls into the category Kubota (2004) would term *conservative multiculturalism,* in that Randall "overtly defends Eurocentric modes of thinking and educational practices" (p. 31). Randall affirms this, stating,

> You have to understand the kind of person they are. Not just the person, but the student that she is. We do look at [state standardized test] scores, but I would place much more weight on what I know of the student.

In this research, I argue that conservative and traditional secondary mathematics teachers such as Randall, who are White, middle class, and English speaking, see the world from a position of power. Apfelbaum (as cited in Brantlinger, 2003) suggested that "dominant groups develop standards based on their own characteristics and customs and expect others to emulate their styles and assimilate to their customs whether it is feasible for them or productive to society" (p. 3). Randall, inspired by and based on his rigid views, has clearly decided which students are the "right kinds of kids" for the upper-level classes, and for him, it is those with the preferred (White) style of discourse and behavior.

These descriptions of effort, as perceived by some mathematics teachers, point toward a preferred "way of being" for students. In other words, students who appear to demonstrate specific behaviors—compliance, tenacity, willingness to review previous material—increase their chances of being viewed as showing good effort. Randall captures the subjectivity of this idea in his interpretation of the state standardized mathematics assessment.

One of the key strategies Randall described using when making his secondary mathematics placement recommendations involved an arbitrary score on the state standardized assessment for middle school students, which has a maximum score of 100. Although the official minimum passing score is 65 (which the state considered indicative of readiness for Algebra I), Randall chose to create his own interpretation of the assessment for these mathematics test scores. With the approval of his school-based mathematics department chair, Randall made the decision that only those secondary mathematics students who scored 80 or higher on the state standardized mathematics assessment would be enrolled in Algebra I—since he deemed these students "worthy" or "ready" in his opinion and in alignment with his "gut feeling." As a result, any student with a score below 80 would be placed in the lower-level, Pre-Algebra course. This means that students with scores between 65 and 80—who had demonstrated mastery of the requisite eighth-grade mathematics content, but did not meet Randall's elevated standard supported by his supervisor—would be denied access to Algebra I.

However, in spite of Randall's stated confidence in his own personal "cut-off" score, he admitted there were times he bent his own rules. He described an example, explaining,

> Now, I deviated from that because I know the students. For instance, I had one girl who doesn't do real, real well on tests, but is very, very bright and … and works her rear-end off … is … I mean … the ideal student.

In probing further about this White, monolingual English-speaking, female eighth-grade mathematics student who fell below his arbitrary criteria for promotion, Randall revealed that he felt she should had been identified and that, according to his gut feeling, she should be promoted. Although Randall had attempted to establish some form of subjective measure of student mastery of content matter, this, too, was influenced by his omniscient interpretation of information.

Conclusion: The Problem of Omniscience in Middle-School Educators

The terms *omniscience* and *omniscient,* or rather, all-knowing, have traditionally been used within the context of theology, specifically in reference to a deity or deities. Many faith traditions hold that a higher power (God) is all-seeing and all-knowing, or omniscient. When used in the context of theology, the concept of omniscience evokes a sense of the absolute, and an omniscient deity is one that enjoys unconditional and unlimited access to universal truths, along with an infinite knowledge of past, present, and future. No domain or era is excluded, but rather, every knowable detail is included. Bourdieu (1991) speaks to this as well, calling it "the Oracle Effect" (p. 211).

In a parallel way, some contemporary, traditional, middle-school mathematics educators, too, may have the sense that they embody omniscience and are all-seeing and all-knowing with regard to the students in their care. Asserting great confidence and minimal modesty, these educators may embrace a traditional interpretation of schools and schooling, in that the teacher knows what is "best" for each learner. Dewey, as quoted in Chall (2002), highlighted this sense of omniscience in traditional teachers, stating, "The center of gravity is outside the child. It is in the teacher, the textbooks, anywhere and everywhere you please except in the immediate instincts and activities of the child himself" (p. 16). Chall quoted Dewey further, explaining a "traditional" model of education as "one of imposition from above and outside" (Chall, 2002, p. 17). While this may have been Dewey's lament in 1900, this traditional, teacher-centered, rote-memorization model of imposition—and the imposition of omniscience—persists, particularly for those students from outside the mainstream, and is as exclusionary and silencing today as it was in Dewey's time.

Freire (2002), too, alluded to this sense of omniscience in teachers in his description of the "pedagogy of the oppressed," where the teacher is an uncritical performer, engaging in "banking education." Freire described banking education as a system wherein "the teacher knows everything and the students know nothing" (p. 73). Freire went on to explain that the teacher who expresses loyalty to the banking model of education also "chooses and enforces his choice, and the students comply," (p. 73) and "chooses the program content, and the students (who were not consulted) adapt to it" (p. 73). The teacher, in other words, holds ultimate knowledge, and ultimate power to make decisions. The voices and perspectives of students are not considered, because in the view of an omniscient teacher, this would serve no purpose. An omniscient teacher does not require the input of students.

Within this teacher-centered, "all-knowing" framework of traditional banking education and symbolic violence, in this research I posit that the concept of omniscience may help to explain some of the attitudes and decisions made by secondary mathematics teachers in the United States, which I contend are problematic in that they may privilege some students while marginalizing others.

Omniscience is defined as being all-seeing and all-knowing, or having infinite awareness, understanding, and insight. In making mathematics placement recommendations for students moving into high school, my findings in this study build upon the work of Bourdieu (1999) and Freire (2002) in their descriptions of omniscient

perspectives. The very act of tracking students is an embodiment of omniscience. Most teachers in this study expressed at least some degree of this kind of omniscience in terms of knowing which courses were most appropriate for each learner in their care. Educators who expressed this idea sent the implicit message that they, as teachers, held ultimate power in making placement recommendations, and furthermore, their decisions, as educators, were correct and should override decisions of others. Although this stance may, at first pass, sound extreme, the frequency with which it was invoked made it quite commonplace, particularly in discussions about placement recommendations for students with historically marginalized identities.

The existence of this perspective of omniscience is problematic in two primary ways. First, there is a mismatch between the demographics of those with power (the teachers) and those without (the students and their families), which has implications for cultural reproduction of achievement and opportunity gaps. Second, the omniscient stance lends itself easily to symbolic violence, with those in power perpetrating aggression upon those with less status.

Thus, as a way to counteract or perhaps neutralize the effects of omniscient teachers, I suggest that school districts increase efforts to require coursework and/or some form of "disposition assessment" to ensure all educators hold at least minimally acceptable levels of regard and respect for all students. Although this is clearly not something easily measured or attained, I believe that for the benefit of all U.S. students, teachers must be imbued with some form of this willingness to listen to and learn from students and their families. Lacking this, the status quo may continue, unimpeded.

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Effects of Culturally Relevant Teaching on Seventh Grade African American Students

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Abstract

The purpose of the study was to examine the relationship between culturally relevant teaching and science achievement in seventh grade African American students when compared to standards-based instruction. The study also examined whether the use of culturally relevant teaching improved students' attitudes toward science, as well as their participation within the science classroom. The intervention was implemented over the course of eight weeks by using a unit test as a pretest and posttest, formative quizzes, a Science Attitude Survey, and field notes to analyze student performance. Although all participants made academic gains when comparing pretest and posttest results, the culturally relevant group made higher gains than the standards-based group. Data from the Science Attitude Survey revealed slight changes in students' overall attitude toward science except in one area. The intervention showed culturally relevant teaching can increase student achievement and improve student participation within the science classroom.

Introduction

During the early 1980s, the Reagan administration publicly announced the "A Nation At-Risk" educational reform which identified a need for improving the science industry; however, this unfortunately did not motivate African American students "who are filled with self-doubt, stereotypes, discouragement, economics, and sometimes just wrong perceptions of what math and science are all about" (NewsOne, 2011; Alexander, 2012; Bell, 1992). Understanding science is imperative because science and technology are ubiquitous, and the industry is growing rapidly. All students

generally have difficulty with science, but African American students struggle more than any other ethnic group. African American students lag behind all other ethnic groups in all content areas, but the percentage of deficit increases within the science content. The major issue with retention of science concepts is communication barriers between teachers and African American students (Foster, Gomillion, Parsons, & Simpson, 2008).

Background Context

The southern United States is home to many African American students, and the state of Georgia is the focus in the current study. According to the Governor's Office of Student Achievement (2011), the majority of Georgia teachers are White, and the number of African American students in Georgia public schools is gradually rising. The lack of communication between teacher and students develops from the different cultural backgrounds of the individuals (Paris, 2012; Redeaux, 2011). African Americans have a distinct communication pattern that does not mimic the communication pattern of science classrooms (Foster et al., 2008). In order to motivate African Americans to aspire to master the science curriculum, teachers will have to become better at employing the communication patterns of their students.

Foster et al. (2008) stated the discrepancy between race, culture, and socioeconomics among teachers and students causes tension in various areas, such as academic achievement. The National Center for Children in Poverty (NCCP, 2010) stated that 49% of African American children live in rural communities and 62% of those children live in low-income families with 52% percent of African American children in rural areas living in single parent homes. Within those homes are certain communication patterns that allow them to connect with their family and friends, but that same pattern is not followed inside science classrooms, which enables children to make connections with their teacher and/or science concepts.

Deficits or difficulties in skill or knowledge: National data. According to the National Center for Educational Statistics (NCES, 2011) eighth-grade science assessment scores, Whites outscored African Americans by 36 points and Hispanics/Latinos by 30 points. Also, students who were not eligible for free/reduced lunch scored 17 points higher than students who were eligible for reduced lunch and 30 points higher than students who received free lunch (NCES, 2011). There lies a distinct link between socioeconomic status and academic achievement, which highlights the need for continued research in various school settings to account for differences across locality, school structure, community composition, race, and intersectionality, in that no person has a single, easily stated identity (Martinez, Tost, Hilgert, & Woodard-Meyers, 2013; Alexander, 2012; Crenshaw, 1991).

Deficits or difficulties in skill or knowledge: Research school. The 2009-2010 Report Card (Governor's Office of Student Achievement, 2011) reported the rural South Georgia district evaluated in this research had a total of 7,425 students enrolled in school. Of the students enrolled in the district, 30 percent (N=2279) were African American, 14% (N=1040) Latinos, and 51% (N=3787) White. The district reported a total of 46 administrators, and only 6 were African American (Governor's Office of

Student Achievement, 2011). The 2009-2010 Report Card (Governor's Office of Student Achievement, 2011) reported 12% (N=66) of teachers in this district were African American compared to 86% (N=485) White teachers and one-tenth percent (N=3) Latina/o teachers. As reported by the Governor's Office of Student Achievement (2011), the middle school in this rural South Georgia district has a total of 123 teachers and 6 administrators. Of the administrators enrolled at the middle school, 17% (N=1) of administrators were African American while 83% (N=5) were White (Governor's Office of Student Achievement, 2011). The middle school in this district has a total of 75% (N=92) White teachers, 23% (N=28) African American teachers, and 2% (N=3) of other ethnicities (Governor's Office of Student Achievement, 2011). The 2009-2010 Report Card (Governor's Office of Student Achievement, 2011) also reported less than 1% (N=3) of the science teachers in this district were African American. This demographic personnel data does not complement the student demographics for this district.

In 2011, the Governor's Office of Student Achievement reported 22% of seventh graders did not pass the Science Criterion Referenced Competency Test (CRCT) at the middle school level in the teacher-researcher's district. Of the underachieving students 31% were African American and 19% were Hispanics/Latinos. The 2011-2012 Report Card (Governor's Office of Student Achievement, 2011) also reported, 26% of those students who did not meet the CRCT criteria originated from low-income families.

Priorities to address deficits or improve performance: Research school. The rural South Georgia middle school in the current study conducted science benchmark tests in grades six through eight, and the achievement gap was apparent between Whites and African Americans. The sixth grade benchmark results indicated Whites answered 64% correct and African Americans answered 53% correct. The seventh grade benchmark results indicated Whites answered 62% correct, African Americans answered 50% correct, and Latinos answered 57% correct. The eighth grade benchmark results indicated Whites answered 53% correct and African Americans answered 43% correct. On average, African American students have a 10% achievement gap from the White students in science. The Latino students are also scoring higher than African American students in science which demands faculty and staff to pay close attention to the African American subgroup.

The South Georgia middle school's Continuous Improvement Plan used for the current research outlines improving curriculum mastery as one of their measureable goals for the 2011-2012 school year (Governor's Office of Student Achievement, 2011). The Continuous Improvement Plan (CIP) also identified two goal areas that focused on African American student achievement. Goal area one stated, "Our first objective is to improve curriculum mastery in all grades on CRCT reading/ELA, math, science, and the Georgia 8th grade writing assessment" (Governor's Office of Student Achievement, CIP, 2011, p. 2). Within goal area one the leadership team specified to increase seventh-grade science proficiency in the African American subgroup to 65%. Goal area two stated, "Our strategic objectives are to improve instructional engagement and resources" (CIP, 2011, p. 3). In order to achieve these goals, the school must focus on the African American students.

Need for research: Professional practice. Based on the 2010-2011 Balance Score Card, this South Georgia middle school has met Annual Yearly Progress (AYP) for the last four years but has not made significant gains (Governor's Office of Student Achievement, 2011). The 2011-2012 CIP seeks to decrease the number of African American students that fail to meet the CRCT passing requirements. Researchers suggest that African American students are often more motivated by African American teachers, but the personnel demographic data displayed does not represent a balance among teacher-student ethnic groups, therefore some teachers are unprepared to teach in a school where the students' life experiences are essentially different from their own (Martinez, Unterriener, Aragon, & Kellerman, in press; Paris, 2012; Redeaux, 2011). Therefore, teachers will have to utilize different learning strategies to encourage African American students to excel in science (Bell, 1992; Valencia, 2010).

The current research is intended to provide teachers with culturally relevant teaching strategies to motivate African American students in science. Teachers will also be able to collaborate with administrators to extend the strategy to the school body. Parents will benefit from this research by becoming aware of the effect their home environment has on their children.

Literature Review

Achievement and opportunity gaps (Carter, Welner, & Ladson-Billings, 2013; Gorski, 2013) among culturally, linguistically, ethnically, and economically ethnic groups present apprehension among educators and policymakers and show that teachers play an important role in the achievement of students (Gabriel, Martinez, & Obiakor, in press; Hughes & North, 2012; Valencia, 2010). Despite mixed evidence found in the literature about both successes and disparities in the education policies, approaches, and achievement of students with diverse backgrounds, when examining the science achievement gap that exists between specific ethnic groups, African Americans and Whites have the largest disproportion (Alexander, 2012; Beecher & Sweeny, 2008). Therefore, the review of the relationship between culturally relevant teaching and science achievement for African American students is essential in identifying effective ways to increase academic achievement, improve attitudes toward science and classroom behaviors.

Understanding the Problem

Students of different cultures and backgrounds struggle to have teachers identify who they really are because of culture and language differences (Griffin, Martinez, & Martin, 2014; Paris, 2012). Culture is fundamental to learning for all students, but affects each one of them differently (Martinez et al., 2013, in press; Nieto & Bode, 2008). Nieto and Bode (2008) also declared if teachers and schools are oblivious of cultural differences it can lead to student and school failure. Many American teachers view culture as irrelevant to education, but the truth is that teachers are not adequately trained to incorporate culture into their lesson plans and are ill-equipped to effectively communicate with different ethnic groups (Gabriel et al., in press; Griffin et al, 2014;

Redeaux, 2011). There have been several strategies introduced to teachers that focus on African American retention of concepts (Nieto & Bode, 2008).

Standards-based instruction. A teaching strategy that focuses on the concept retention is standards-based instruction. Standards-based instruction is the process of designing, assessing, and teaching students according to state standards. This type of instruction can be achieved by using differentiation strategies to assure all students obtain the same knowledge, but using different techniques. Allcock and Hulme (2008) questioned if different learning styles were a basis for differentiation to increase the knowledge of A-level students, in comparison to literary capabilities. Students in two classes of A-level psychology were examined. In one class, differentiation was organized by learning styles; and in the other class, differentiation was organized by academic ability. The two learning styles used were Honey and Mumford's Learning Styles Questionnaire (2006) and Gardner's Multiple Intelligences (1993). The study was conducted for a nine week period and monitored by class tests. Pre and posttests were provided to 33 participants, ages 17- to 19-years old (12 males and 21 females). There were a total of 17 students in the ability group and 16 students in the learning style group. Before the intervention, all students were given a pretest on a previous concept taught and two questionnaires. The teacher thoroughly planned for each lesson with differentiating activities for each class. After the implementation, both classes took a posttest over a concept taught during the intervention and another questionnaire concerning their experiences in the experiment. After data analysis, the authors concluded both classes significantly advanced from their pretest to final test, but there was no substantial difference in enhancement between the two groups.

The results from Allcock and Hulme (2008) yield the same conclusion as Beecher and Sweeny (2008) on the basis of differentiation. Beecher and Sweeny (2008) used curriculum enrichment and differentiation to decrease the achievement gap and increase student achievement in different ethnic and socioeconomic groups in an elementary school. The research was completed over an eight year period to include quantitative and qualitative data. The school improvement planning team at Central Elementary School (CES) developed a school mission to integrate gifted and talented strategies into the curriculum and detailed plans of action. The plan of action included (a) a school-wide enrichment team that includes parents and teachers to enrich and enhance student learning, (b) differentiation training for staff, (c) interdisciplinary differentiated lessons to include standards-based instruction, and (d) an extended day enrichment program. After implementing the eight year strategic plan, CES compared their 1997 state test scores to the 2004 state test scores. The analysis of the data indicated improvement in all subjects and a narrowing of the achievement gap from 62% to 10%. All ethnic and socioeconomic groups showed improvement in academic achievement. Results from the students in the lower socioeconomic status were reduced by 28% and the higher socioeconomic status was lowered to 4%. Allcock and Hulme (2008) and Beecher and Sweeny (2008) research studies both determined differentiation does increase academic achievement. Although academic achievement was increased, the student's attitudes towards science were not tested as a variable.

Attitude toward science. Some researchers propose African Americans have adverse attitudes, images, and interests towards science. Christidou (2011) believed science teachers portrayed a negative image of science to their students, especially girls, that initiates a negative attitude towards science. Students believe science is not relative to everyday life and they consider scientific professions to be a fantasy. Additionally, the author stated popular science is also tainted and portrays the stereotypical image of an old White male with glasses in a lab coat (Christidou, 2011, Bell, 1992). The authors of NewsOne (2011) agreed with Christidou about the stereotypes within science that give African Americans a false image of science.

Christidou (2011) implied that science teachers, science textbooks, and popular science must be reformed to influence students' interests and attitudes and recommended that new research involve the reform of science teachers, science curricula, and popular science to reveal a correlation between the way science is taught to students and the images of science the students depict. Christidou (2011) also advised that race, gender, age, and socioeconomic status be explored along with the relationships mentioned to address critical issues in science.

Christidou's (2011) study is related to Kirikkaya and Vurkaya (2011) who implemented alternative types of assessments to impact student success and attitudes. In comparison to conventional assessments, alternate assessments are used to yield positive results by developing higher order thinking skills. Kirikkaya and Vurkaya (2011) used three types of alternative assessments; structural communication grid (SCG), diagnostic tree, and predict-observe-explain activities and concluded that alternative assessment activities positively influenced students' science attitudes and increased their academic achievement because of the increase in test scores.

Culturally relevant teaching. The current research seeks to introduce culturally relevant teaching into classrooms in order to increase academic achievement. Previous studies have been conducted on cultural influences on academic achievement (e.g. Gay, 2010; Ladson-Billings, 1994, Paris, 2012; Scherff & Spector, 2011). Jackson and Jackson (2011) revealed that culturally relevant teaching helps students develop the necessary learning skills, and teachers that use this theory create a social relationship with their students to promote a safe and nurturing environment inclusive to learning. Jackson and Jackson (2011) addressed the social and academic needs of middle school African American students by using culturally relevant pedagogy theory and examined the beliefs and perceptions of middle school science teachers on culturally relevant teaching. In this study eight middle school teachers of low-income, African American students agreed to participate in this research study. The participants completed a two-part Likert-type scale questionnaire with items about beliefs and attitudes. Of the participants, four agreed to being interviewed for one hour answering questions regarding personal histories, culturally relevant teaching, and challenges they face as a teacher. Jackson and Jackson (2011) identified one teacher from the data analysis of the questionnaires and interviews to observe for the study. The African American female science teacher identified was observed every two weeks for six weeks at different times of the day. The authors gathered artifacts, audio files, and extensive field notes to draw a conclusion about culturally relevant pedagogy. Jackson

and Jackson (2011) determined that culturally relevant teaching helps students develop the necessary skills, and teachers that use this theory create a social relationship with their students to promote a safe and nurturing environment inclusive to learning.

Fierros and Conroy (2002) reported two developments in their data analysis. The first trend the authors noticed was that minority students were more likely to be removed from regular education classrooms than White students. The second trend Fierros and Conroy (2002) identified was how the African American students are often over-identified in disabilities. Christenson, Sinclair, and Thurlow (2005) implemented the check and connect intervention. The check and connect intervention identifies students who are at risk of dropping out of school and pairs them with mentors to focus on their needs. Christenson et al. (2005) found that the check and connect intervention decreased the dropout rate and increased school completion rates.

Limitations of the literature. Hayling, Kern, Serpell and Stevenson (2009) found a demand for culturally-responsive school-based intervention because African American males perform better in classroom culture that corresponds to their environmental culture. Christidou (2011) suggested that new research must involve the reform of science teachers, science curricula, and popular science to reveal a correlation between the way science is taught to students and the images of science the students depict. Christidou (2011) also suggested that race, gender, age, and socioeconomic status also be explored along with student-teacher relationships to address critical issues in science. Patricia Hill-Collins (2000) argued the same sentiments and noted that, “the politics of race and gender also influence knowledge.” Calebrese-Barton concurred with Christidou (2011) and Hill-Collins (2000) when she discussed how “science education has not incorporated the needs or concerns of children in poverty and children from ethnic, racial, and linguistic minority backgrounds” (Barton, 2001, p. 648).

There are several factors influencing African American academic achievement that have been identified: student’s attitudes, images and interests of the subject; teacher-student closeness; and cultural compatible education. Although these factors are imperative, they do not address how science teachers will be regenerated to become culturally responsive to African American provisions. When teachers become culturally responsive they will assess the ability to communicate effectively with African American students to increase their academic performance. Once teachers have become culturally aware, not necessarily competent or proficient, they will be able to effectively communicate with their African American students to increase science achievement within the subgroup.

Purpose Statement

The purpose of the study was to examine the relationship between culturally relevant teaching and science achievement in seventh-grade African American students within the classroom when compared to standards-based instruction. Student attitudes and behaviors toward science were also measured for improvement. Students, teachers, administrators, parents, and district leaders will benefit from this research by

identifying effective communication with African American students to increase academic achievement, improve their attitude toward science and their classroom behavior.

Research Questions

Research question 1. Will culturally relevant teaching increase seventh-grade African American students' science achievement compared to standards-based instruction?

Research question 2. Will culturally relevant teaching increase seventh-grade African American students' attitudes toward science compared to standards-based instruction?

Research question 3. Will culturally relevant teaching increase seventh-grade African American students' engagement compared to standards-based instruction?

Definitions of Variables

Culturally relevant teaching. Culturally relevant teaching is a type of teaching strategy that is attentive to different cultures within the classroom (Gay, 2010; Ladson-Billings, 1994, Paris, 2012; Scherff & Spector, 2011). The teacher-researcher implemented culturally relevant teaching by utilizing role playing as a means for students to display their knowledge of science concepts (Jackson & Jackson, 2011).

Standards-based instruction. Standards-based instruction requires a student-centered environment with the teacher-researcher acting as a facilitator (Allcock & Hulme, 2008). The teacher-researcher will use standards-based instruction for the control group.

Science achievement. Science achievement is the increase in the attainment of science standards. The teacher-researcher measured science achievement by using test and quiz scores.

Attitude toward science. Attitude is a personal evaluation of concepts; an expression of favor or disfavor toward science (Christidou, 2011). Student attitudes toward science were measured by a survey.

Behavior. Behavior is a manner of behaving, acting and reacting (Christidou, 2011). Classroom behavior was measured by the use of behavior charts and graphs.

Methods

Setting and Participants

This research was conducted in a science classroom at a middle school located in rural South Georgia. The county had an estimated population of 42,356 residents,

73.5% of whom were high school graduates and 12.1% of whom graduated with a Bachelor's degree or higher (U.S. Census Bureau, 2010). The high percentage of high school graduates compared to the low percentage of college graduates indicates a low number of students attend college from this area, which identifies the average student from this area does not have college educated parents. The 2010 U.S. Census identified that the county had a $31,761 median household income and 25.9% of persons were living below the poverty level, all of which are lower than the state reported data (U.S. Census Bureau, 2010). The county's high poverty level indicates an economically distressed community.

The Continuous Improvement Plan identified 1,746 students in grades six through eight at this middle school (2011). There were 572 students in the seventh-grade. Table 1 illustrates the racial makeup of the middle school. Majority of the students at this middle school were from low-income families and the student ages ranged from 12-15.

Table 1

School demographic data

Demographic		Percentage
Ethnicities	African American	32
	White	52
	Latino	7
	American Indian	7
	Multiracial	1
	Asian	1
Regular Education		7
Students with Disabilities		9
English Language Learners (ELL)		2
Migrant		1
Gifted		11

A heterogeneous, convenience sample was used by the researcher to select participants for this study. The participants in this research were 50 seventh-grade students in two Science classes at a middle school in rural South Georgia. The current study focused primarily on the 15 African American students as shown in Tables 3 and 4. Demographic characteristics and achievement data provided by the 2010-2011 Report Card (Governor's Office of Student Achievement, 2011) of both the standards-based group and the culturally relevant group are provided in Table 2. Each of the students with a disability identified in Table 2, had an Individual Education Plan (IEP)

that addressed needs, goals and supports for their disability. Analysis of the data in Table 2 indicated that majority of the students scored on Level 1. The analysis indicated that only a few students meet the standards which specify a need for an increase of academic achievement (Governor's Office of Student Achievement, 2011).

Table 2

Demographic and achievement data for the standards-based and culturally relevant classes

		Standards-based	Culturally relevant
Demographic		*N=28*	*N=22*
Ethnicities	African American	7	8
	White	14	10
	Latino	7	4
Gender	Males	13	13
	Females	15	9
Students with Disabilities		2	1
English Language Learners (ELL)		1	1
Migrant		1	1
Gifted		6	0
Achievement			
Level 1		15	16
Level 2		9	6
Level 3		4	0

The culturally relevant group was the second class of the day and experienced culturally relevant teaching; and the standards-based group was the last class of the day and experienced standards-based instruction. There were more males than females in this study. In the culturally relevant class, the number of students who scored at Level 1 was 16, 6 at Level 2, and none of the students scored at Level 3, on the science section of the CRCT (Governor's Office of Student Achievement, 2011). In the standards-based class, the number of students who scored at Level 1 was 15, 9 at Level 2, and 4 at Level 3, on the science section of the CRCT (Governor's Office of Student Achievement, 2011).

The teacher-researcher was an experienced seventh-grade life science teacher and taught both the standards-based group and the culturally relevant group. The teacher-researcher was responsible for lesson plan development, content delivery, instructional delivery, pacing guides, and assessment creation, as well as administration of all science curricula.

Intervention

A mixed methods design was used in this research, which required the collections of both qualitative and quantitative data (Creswell, 2008). The qualitative data obtained were used to corroborate the quantitative data. The standards-based (SB) class was the control group and the culturally relevant teaching (CRT) class was the treatment group. Students were assigned to each block by the assistant principal prior to the beginning of the school year as usual. The intervention phase of the study took place during weeks two through eight of the first semester. During this time period, students received instruction on two science units. The first unit was a preview-review unit over lab safety, lab rules, metric system, and science tools. The second unit covered cells and body systems. Each class received 60 minutes of science content instruction daily from the same teacher in whole group and small group settings. Students were paired in groups according to their Lexile reading level. Behavior was noted on behavior charts daily in both groups by the teacher-researcher and evaluated in comparison to assessment scores.

The standards-based (SB) class received instruction from the teacher-researcher. The teacher-researcher used various standards-based strategies to present the content to the students. Every lesson was opened by using an activator and closed by using a summarizer. Instruction was provided by using explicit instruction. Explicit instruction provided the students with an example by the teacher first. Subsequently, the students assisted the teacher with an example. Next, the teacher assisted the students. Finally, the students provided an example while the teacher observed. The teacher-researcher assumed the role of facilitator; while the students were the instructors in the SB class.

The culturally relevant teaching (CRT) class received instruction from the teacher-researcher. The teacher- researcher used various culturally relevant teaching strategies to present the content to the students in this group such as role playing, researching different scientists of different ethnic backgrounds, and putting their knowledge to music (Jackson & Jackson, 2011). At the end of every class, the students wrote in their journals to express their feelings or questions about a lesson. The teacher-researcher read the journals each Thursday to provide feedback to the students and to answer any questions before an assessment. In the CRT class, the teacher guided students' concepts and rationales and the students were motivated to increase their knowledge of science.

Both groups were given the same assessments. Quizzes were given on Fridays in a multiple-choice format. A unit test was administered before and after instruction for both units. Students entered their scores on the classroom response system to receive immediate feedback and scores. The classroom response system would also chart

each student's progression throughout the unit; as well as the entire class. Science attitude surveys were also entered and scored on the classroom response system at the beginning and the end of the intervention. All data were gathered and analyzed by the teacher-researcher.

Data Collection

The teacher-researcher used the following instruments to determine if achievement and attitude toward science improved when seventh-grade students were taught using culturally relevant teaching strategies in comparison to standards-based instruction.

Quizzes. The quizzes given were 10 to 15-item teacher-researcher developed multiple choice tests that assessed the science comprehension of seventh-grade students (see Renaissance Learning, 2013). The quizzes were given weekly. Each item on the quiz was worth equal value totaling 100 points. The SB and CRT groups were given the same quizzes. The quizzes were developed by the teacher-researcher using the unit test as a template. Content validity was established by a peer review completed by two content teachers (e.g., Renaissance Learning, 2013). The scores of the SB group were compared with the scores of the CRT group to determine if the students' academic achievement increased. Data were analyzed using descriptive statistics (*M*, *SD*) and an unpaired one-tailed *t*-test (Creswell, 2008).

Science test. The science test given before and after intervention was a teacher-developed 20-item multiple choice test that assessed the science comprehension of seventh-grade students. Each item on the test was worth equal points. The test was developed by the teacher-researcher and the seventh-grade science Department Chair. During the collaboration, the teacher-researcher and department chair selected questions from the Georgia Department of Education Online Assessment System (Georgia Department of Education, 2010) and Study Island. The SB group and the CRT group were given the same test. The test was given at the beginning and the ending of each unit. There were two certified science teachers who conducted a peer review to establish content validity. The scores of the SB group were compared with the scores of the CRT group to determine if the students' academic achievement increased. Data were analyzed using descriptive statistics (*M*, *SD*) and an unpaired one-tailed *t*-test (Creswell, 2008).

Science attitude survey (SAS). The survey was a 20-item teacher-developed instrument administered at the beginning and ending of the study to both groups. The instrument used a 5-point Likert-type scale (scored 1 – *I strongly agree*, 2 – *I agree*, 3 – *I am not sure*, and 4 – *I disagree*, 5 – *I strongly disagree*). The survey was developed to measure students' attitudes toward science. Content validity was established by pilot testing conducted by two students. The two students read a copy of the survey for clarity and understanding. Differences in attitude about science before and after the intervention were examined. Themes that emerged were discussed and compared for effects of intervention on students' attitude toward science. A paired one-tailed *t*-test was performed along with descriptive statistics (*M*, *SD*) to analyze data (Creswell, 2008).

Behavior chart. The behavior chart was a teacher-revised document that was used with both the standards-based (SB) group and the culturally relevant teaching (CRT) group (Mauro, 2012). The behavior chart contained the following information: participants' name, date, goals to achieve, and consequences. Students identified three behavior goals to be achieved during the nine weeks while in class. The consequences for not achieving those goals were as follows: first infraction: warning, second infraction: student will serve silent lunch, third infraction: teacher will contact parents, and fourth infraction: student will receive a discipline referral. A remarks section was provided for parents' signature and a description of the incident. Content validity was established by pilot testing conducted by two students. The two students were given a copy of the behavior chart to determine if they could understand the language and diagrams of the chart. The behavior chart was completed daily by the teacher at the end of class. A comparison was made of the number of behaviors displayed with how often the behaviors were displayed. Another comparison was made between the two classes. Data were analyzed using descriptive statistics (*M*, *SD*) and a paired one-tail *t*-test (Creswell, 2008).

Field notes. The teacher-researcher recorded field notes of any incidents that might have affected the intervention, such as students' behavior, classroom interruptions, or other relevant information that may have affected the study. Field notes were used to document themes or patterns in student behaviors, attitudes, questions, and comments during the intervention phase. These notes were used to explain incidents that might have increased or decreased the effectiveness of the intervention. The data were organized by using descriptive codes. All data was coded and analyzed for descriptive themes and patterns (Creswell, 2008). Based on the findings, a narrative was written to summarize the results.

Results

The purpose of this study was to determine the effect of culturally relevant teaching on seventh grade African American students' science achievement, attitude, and behavior compared to standards-based teaching in a rural South Georgia middle school. Results of the study were based on the teacher-researcher's analysis of students' pretest and posttest results, scores on weekly quizzes, responses to science attitude survey questions, and field notes.

A unit test was given as a pretest to provide a baseline for determining the amount of science knowledge the students had before the intervention began. Both the CRT and SB groups were administered the same pretest at the beginning of the study. This same unit test was given as a posttest at the end of the study and a comparison of scores was performed.

The data from the pretest and posttest scores; as well as, the comparison of scores are shown in Table 3. Means and standard deviations for both the pretest and posttest for both groups are also shown below in Table 3.

Table 3

Science Pretest & Posttest Achievement

		Pretest		Posttest		Mean Gain/Loss	Comparison of Mean Gain/Loss	
Class	*N*	*M*	*SD*	*M*	*SD*		*t*-value	p
Standards-based	8	32.13	13.97	69.25	17.85	37.12	-1.29	.11
Culturally-relevant	7	20.43	13.19	65.14	9.04	44.71		

*p < .05; ** p < .01

The SB group scored 11.70 points higher (*M* = 32.13, *SD* = 13.97) than the CRT group (*M* = 20.43, *SD* = 13.19) on the pretest. The pretest data in Table 3 revealed the SB group had more prior knowledge of the concepts taught than the CRT group. The SB group also scored 4.11 points more than (*M* = 69.25, *SD* = 17.85) the CRT group (*M* = 65.14, *SD* = 9.04) on the posttest. Although the SB group scored higher on the pretest and posttest, the CRT group made a higher gain. However, the mean gain of the CRT group was not significantly different (*t* (13) = -1.29, *p* = 0.11) from the SB group. The groups are similar enough for comparison. Based on the data in Table 3, the CRT group did improve their academic achievement, but not significantly.

Cohen's *d* was used to calculate the effect size of the implementation of culturally relevant teaching on science achievement. There was a significant difference in the mean scores of the two groups (see Table 2), but the CRT group had a small effect (*d* = 0.31) on posttest scores.

The teacher-researcher expected that an average student in the CRT group would outperform about 62% of the students in the SB group. However, scores for both groups showed an increase from pretest to posttest with the CRT group showing an increase of 44.71 and the SB group 37.12. Culturally relevant teaching increased scores approximately 6%; therefore, increasing student achievement.

A comparison of the achievement of both the CRT and SB groups on weekly achievement quizzes (e.g., Creswell, 2008; Renaissance Learning, 2013) are shown in Table 4. Both groups were tested weekly by using quizzes. Table 4 shows the mean and standard deviations for both groups' quiz scores for four weeks.

Table 4

Weekly Science Achievement Quiz Data

		Quiz 1		Quiz 2		Quiz 3		Quiz 4	
Class	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Standards-based	8	72.83	9.66	63.13	19.07	78.13	20.45	65.25	32.08
Culturally-relevant	7	69.86	19.11	60	14.14	73.71	17.72	71.43	48.86

The data in Table 4 revealed that student scores in both the SB and CRT groups decreased on quiz 2 from the scores on quiz 1. Both the CRT and SB groups made gains on quiz 3 after the initial decrease in scores, but the CRT group continued to increase from their initial mean score, while the SB group decreased on quiz 4. After analyzing the data, the CRT group outperformed the SB group on weekly quizzes.

Means and standard deviations for each graded assessments are provided in Table 4. The mean score of the CRT group (M = 68.75, SD = 16.06) was not significantly different (t (15) = 0.24, p = 0.41) from the mean score (M = 69.83, SD = 9.19) of the SB group after being taught using different strategies of culturally relevant teaching. Cohen's d was used to calculate the effect size of culturally relevant teaching on African American science achievement. The intervention had a negligible effect (d = 0.09) on student quiz scores. An average student in the SB group would be expected to outscore about 54% of the students in the CRT group. Culturally relevant teaching would decrease quiz scores by only 2%. Therefore, the implementation of culturally relevant teaching did not significantly impact African American students' science achievement when assessed using weekly quizzes.

Data were obtained on student attitudes towards science from the surveys that were administered before and after completion of the intervention. Students were asked to complete the surveys using a 5-Likert scale. The responses ranged from 1 for "strongly disagree" to 5 for "strongly agree." Student responses to the pre and post intervention survey for the CRT group and the SB group are summarized in Table 5. The results of the pre and post intervention science attitude survey for the CRT group and SB group are shown in Table 5. The percentage of students in the CRT group who strongly agreed or agreed that science was fun increased from 65% prior to the intervention to 69% after implementation of the intervention. While the percentage of students who strongly agreed or agreed science was fun in the SB group decreased from 57% to 46%.

This data analysis revealed that some of the students in the CRT group that either disagreed or strongly disagreed changed their enthusiasm for science increased after the intervention.

Table 5

Science Attitude Survey

	Culturally-relevant Group				Standards-based Group			
	% Strongly Disagree or Disagree		% Strongly Agree or Agree		% Strongly Disagree or Disagree		% Strongly Agree or Agree	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Science lessons are fun.	35%	31%	65%	69%	43%	54%	57%	46%
I really enjoy going to science class.	24%	25%	76%	75%	43%	31%	57%	69%
I look forward to science class.	59%	44%	41%	56%	86%	77%	14%	23%
A job as a scientist would be interesting.	59%	56%	41%	44%	64%	62%	36%	38%
Science is one of the most interesting school subjects.	31%	0%	69%	100%	31%	21%	69%	79%
I would like to learn more about science.	18%	19%	82%	81%	36%	31%	64%	69%
My science teacher motivates me to do my best.	12%	13%	88%	89%	0%	23%	100%	77%
I would like to learn more about science	41%	19%	59%	81%	14%	31%	86%	69%

Table 5 revealed that the percentage of students who strongly agreed or agreed they looked forward to science in the CRT group increased from 41% to 56% after the implementation of the intervention. In the SB group, the percentage of student who strongly disagreed or disagreed that they looked forward to science decreased from 86% to 77%. Therefore, in both groups some students began to look forward to science. After analyzing the data, the teacher-researcher concluded that some students' attitudes toward science did positively change after the implementation of culturally relevant teaching.

In the CRT group, the percentage of students shown in Table 5 who strongly agreed or agreed that their science teacher motivates them to do their best increased from 88% to 89% after the implementation of the intervention. The percentage of students in the SB group who strongly agreed or agreed that their science teacher motivates them to do their best decreased from 100% to 77%. The results of the science attitude survey showed students maintained a positive attitude towards science in the CRT group. The results of the science attitude survey showed the positive attitude of students in the SB group decreased during the study, but the attitude of the students in the CRT group increased. This analysis revealed that the teacher-researcher motivated the students of the CRT more by using the different teaching strategies used during the implementation.

The data in Table 5 revealed that the attitudes of the students in the CRT group did change after the implementation. On average, the implementation positively impacted 12% of the students in the CRT group. After analyzing the data, culturally relevant teaching did improve seventh grade African American students' attitudes toward science compared to standards-based instruction.

A field journal was utilized throughout the course of the study. The field journal was used to make note of occurrences of discipline issues, off-task behaviors, and increased or decreased effectiveness of the intervention. These issues were also noted on students' behavior charts for parents to sign. Behaviors noted were off-task behavior, talking, and nonparticipation. At the beginning of the study, more students received demerits for behavior. There was a pep rally scheduled during the intervention period and it was hard for the students to focus and settle back down to work. The teacher-researcher noted behavior incidents on four of the students' behavior charts on the day of the pep rally. There were also behavior notes within the field journal provided by substitute teachers for five days the teacher-researcher was absent from school due to illness. On those five days, behavior increased and the implementation was not put into practice. On four out of the five days, three students received discipline referrals for various behaviors, such as fighting and insubordination.

Student completion of daily assignments also increased during the implementation of the study. The teacher-researcher recorded instances of off-task behavior in which one student in particular had to be redirected to the task at hand at least twice daily during the implementation of the study. The teacher-researcher noted gains in student willingness to work with a peer in order to complete assignments. Over the timeframe of the study, the field notes revealed a pattern of decreased off-task behavior in both the SB group and the CRT group. By the last week of the study, only two behavior charts were sent home in each group. After further analyzing the field notes themes and patterns with the behavior chart data, behavior was not significant in either but improved in both the SB and CRT group.

After analyzing the data within the tables, the CRT group did increase their science academic achievement when compared to the SB group. Although all participants made academic gains when comparing pretest and posttest results, the culturally relevant group made higher gains (44.71) than the standards-based group

(37.12). Data from the Science Attitude Survey revealed slight changes in students overall attitude toward science except in one area. In the culturally relevant group, 100% of the students agreed that science was an interesting subject after the intervention compared to 79% of the standards-based group. Although culturally relevant teaching did not decrease the behavior more than standards-based instruction, it did improve the classroom behavior of seventh-grade African American students. Culturally relevant teaching increased African American student academic achievement, and improved student participation and classroom behavior within the middle school science classroom.

Discussion

To determine the effect of culturally relevant teaching on African American seventh grade students, the teacher-researcher compared achievement data scores of a standards-based group and a culturally relevant group before and after intervention. The results of the pretests and posttests, as well as weekly science quizzes, were compared to determine the effect of culturally relevant teaching on African American science achievement. The responses of students on a science attitude survey were also compared to determine the effect of culturally relevant teaching on the attitudes of African American seventh grade students. The teacher-researcher also used the number of behavior charts from beginning to end of the intervention, as well as field notes to determine the effect of culturally relevant teaching on classroom behavior.

In order to determine whether achievement increased when students were taught using culturally relevant teaching compared to standards-based teaching in science, the teacher-researcher utilized pretest and posttest results to determine the academic growth of students. When comparing the pretest (M = 32.13, SD = 13.97) and posttest (M = 69.25, SD = 17.85) data of the standards-based group, there were significant gains (37.12); however, when comparing the pretest (M = 20.43, SD = 13.19) and posttest (M = 65.14, SD = 9.04) data from the culturally relevant group, the culturally relevant group made higher gains (44.71). Therefore; culturally relevant teaching increased the science achievement of African American seventh grade students. This finding was in concurrence with Hayling, Kern, Serpell and Stevenson's (2009) findings that African American perform better in a classroom culture that corresponds to their environmental culture.

Weekly science quizzes were also utilized to determine the effect of culturally relevant teaching. A quiz was given weekly to assess the knowledge of the students. The teacher-researcher established that the results of the pretest and posttest data of the standards-based group corroborated the results of the quiz mean score (M = 72.83) prior to the intervention being significantly different from the mean (M = 65.25) after the intervention. The mean scores (M = 69.86) of the culturally relevant group before intervention were lower than the mean score after intervention (M = 71.43), which determined an insignificant increase for the intervention group. Although pretest and posttest results denoted significant gains in academic performance for all participants, no significant gains were noted on weekly quiz scores. Results were similar to the findings of Jackson and Jackson (2011), who determined that culturally relevant

teaching helps students develop the necessary skills and aids teachers that use this theory to create a social relationship with their students to promote a safe and nurturing environment inclusive to learning. An importance was placed on positive student-teacher relations during classroom activities and discussions. This too was in concurrence with the results from Jackson and Jackson (2011) because of the relationships that were created due to the culturally relevant teaching style.

In order to determine whether students' attitude towards science improved after receiving culturally relevant teaching compared to standards-based teaching, science attitude surveys were completed by participants. Comparisons of student responses before and after the intervention were analyzed. Data from the survey revealed that students maintained a positive attitude towards science in the culturally relevant group. The results of the science attitude survey showed the positive attitude of students in the standards-based group decreased during the study. Before the intervention in the culturally relevant group, 65% of students agreed that science lessons were fun, 41% of students looked forward to science class, 59% would like to know more about science, and 69% of the students agreed that science is one of the most interesting school subjects. After the intervention of the culturally relevant group, 69% of students agreed that science lessons were fun, 56% of students looked forward to science class, 81% would like to know more about science, and 100% of the students agreed that science is one of the most interesting school subjects. In the standards-based group, 43% of the students disagreed with the statement science lessons were fun before intervention and after the intervention 54% disagreed with the same statement. In the standards based group, 100% of the students agreed that their science teacher motivated them to do their best; this number decreased to 77% after the intervention. The results of science attitude survey showed students maintained a positive attitude towards science in the culturally relevant group. The results of the science attitude survey showed the positive attitude of students in the standards based group decreased during the study. The results of this study concur with the results of Christidou (2011) which revealed a correlation between the way sciences is taught to students and the images of science the students depict.

The students of the CRT group improved their positive attitude toward Science and decreased the number of classroom behavior issues within the science classroom. At the beginning of the intervention, the CRT group averaged four (50%) behavior charts a week to be set home and signed by their parents and the SB group averaged three (43%) behavior charts a week. At the end of the intervention, both groups were averaging two behavior charts being sent home, but for the CRT group the percentage decreased to 25% and the SB group 29%. Therefore, the culturally relevant teaching did improve the classroom behavior of African American students compared to standards-based instruction.

Although data from the survey were not statistically significant after the implementation of the intervention; pretest and posttest scores, weekly quiz scores, behavior charts and analysis of field notes suggest the participants' achievement, attitudes, and behavior toward science improved slightly.

Implications and Limitations

Culturally relevant teaching has been proven to be an effective strategy to improve student achievement at various academic grade levels and subject areas (Carter et al., 2013; Gorski, 2013). Although standards based instruction has been proven to be effective in improving student achievement, educational researchers propose that culturally relevant teaching is more effective in increasing student achievement and attitude towards science. The implications of this study are important because they reveal some statistical significance regarding academic gains; improvements in achievement, attitude, and behavior. There are not any school-wide strategies in place currently that positively impacts African American achievement.

Another implication of the research is the limited amount of research on culturally relevant teaching in a middle grades science classroom. Majority of the research discussed differentiation or standards-based instruction in middle school. There were minimal research articles on culturally relevant teaching that were implemented at the middle school level, especially as it relates to science education. The intent of the study was to explain the use of culturally relevant teaching strategies in order to obtain the full benefit of the strategy. The extension of the study is to improve student achievement and attitude towards science. As the achievement increases, teachers and administrators can discuss possible implementation within all classrooms. This process would require further professional development on behalf of the teachers and administration.

Limitations may stem from issues related to the teacher-researcher's influence on the setting or the individuals being studied (Creswell, 2008), which included the number of participants of the study. There were 50 participants in this study, but only 15 were African American, which could have lessened the reliability of the data. The 15 participants were mostly female, which could also limit the amount of data because girls often times outscore boys in academic areas (Robelen, 2012). Additionally, the time frame in which the study was conducted limited the effective use of the strategies. There were also interruptions in the implementation which could have caused students to score poorly on some assessments. Also, the study was only conducted on African American students. Whether culturally relevant teaching will increase academic achievement for other ethnicities is unknown in this study. Therefore, the validity and reliability of the results were limited due to students' limited timeframe of culturally relevant teaching.

Lastly, the teacher-researcher's possible cultural bias may have affected the validity of the research. Interpreting and judging culturally relevant instruction by ideal characteristics to diverse cultures can be problematic. It is possible that the teacher-researcher may have compensated or made assumptions about language and/or social norm representation. The teacher-researcher' familiarity with students could have affected participants' responses to the science attitude surveys and/or skewed their answers to the assessments because of their relationship with the teacher-researcher. Results of the science attitude surveys, in addition to observations recorded in the field notes, were self-reported by the teacher-researcher, which increased the potential bias

in the reported results. Some of the data recorded could have been opinionated because they were self-reported which could have resulted in bias information.

Factors Influencing Implementation

Several factors influenced the implementation of the study. The implementation time was reduced due to time restraints and different unit lengths. Originally, the teacher-researcher planned to complete the study within nine weeks; however, within that time frame three units would have been taught. Therefore, three different pretests and posttests would have been administered and would have potentially skewed data. Due to time constraint, the study only took place within the span of eight weeks overall. The strategy possibly would work better if it were implemented for a longer period of time.

Off-task behavior also influenced the performance of students. The teacher-researcher noted several instances where students were not actively involved in class while taking notes or during class discussions. A number of students were not consistently taking their medication, which helped them focus on daily instruction and some students caused behavior problems which distracted learners. Student and teacher-researcher absences also influenced the results of this study. If the students were absent one or more days, they missed valuable instruction which could have led to low scores on tests and/or quizzes. The days the teacher-researcher was absent the implementation was postponed which could have also led to low achievement scores.

Significance/Impact on Student Learning

The implementation of culturally relevant teaching on student achievement did not significantly impact student achievement when comparing pretest and posttest scores. However, over 50% of the participants of the study made a gain in some degree. It is imperative that African American students make academic gains in science because of the school's goal to increase African American students' science performance on standardized assessments. Student scores were also conclusive towards the benefits of culturally relevant teaching in comparison to standards-based teaching through teacher lectures. The teacher-researcher used various teaching strategies with the culturally relevant group (Jackson & Jackson, 2011). The benefits and strategies of culturally relevant teaching are well documented by the teacher-researcher and can be utilized for any subject area. Further studies like the implementation of the current research may result in the improvement of culturally relevant teaching on science achievement with the ultimate goal of preparing all students for future success in education. Expanding the scope of the research to include related developmental teaching and learning skills that may impact teacher and student cultural proficiency may also increase the opportunities for improving understanding of best practices in science instruction.

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Four Reasons Why Pre-service and Practicing Teachers Should Present at Professional Conferences

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Abstract

During the Fall 2013 semester, two pre-service teachers, one practicing teacher, and a university professor from Peoria, Illinois presented a speed learning session at the Association for Middle Level Education (AMLE) Annual Conference in Minneapolis, Minnesota. After disseminating information about an innovative classroom partnership, attending and presenting at the conference provided an authentic professional experience for the teacher-presenters. In addition to describing the background, travel planning process, and conference experience itself, this article offers four reasons why pre-service and practicing teachers should present at professional conferences: increased confidence and motivation, classroom applications, connections with fellow professionals, and reciprocal support.

Introduction

During the Fall 2012 semester, pre-service teachers enrolled in an advanced language arts instructional methods course at Bradley University in Peoria, Illinois participated in a semester-long partnership with a sixth grade class at nearby Roosevelt Magnet School. Five times during the semester, 20 pre-service teachers enrolled in the course visited 28 Roosevelt sixth graders to conduct a mini-unit focused on reading comprehension, vocabulary development, and expository writing. Immediately following each day's instruction, the pre-service teachers led a rotation of fitness stations that engaged the sixth graders in exercises to develop flexibility, aerobics, strength, and balance.

The following April at a college-wide mini-conference, four pre-service teachers from the course presented a poster describing the classroom partnership. The poster presentation allowed the pre-service teachers to "get their feet wet" in terms of presenting at a professional conference. In the meantime, their professor submitted a presentation proposal for a speed learning session (a 20-minute small group presentation and interactive discussion delivered three times in a row) at the 2013 Association for Middle Level Education (AMLE) Annual Conference for Middle Level Education, a national conference attended by thousands of education professionals each year.

The power of the proposed speed learning session was the opportunity for participants to hear about the literacy/fitness classroom partnership from the perspective of all parties involved: the university professor (Jana), the sixth grade teacher (Teresa), and two pre-service teachers (Megan and Alyssa). Quotations and anecdotes from some of the sixth grade students were also incorporated. The proposal, which was accepted in July, stated that the presentation would provide a brief overview of the partnership's structure, engage participants in question-and-answer discussion, and conclude with open-ended discussion of participants' ideas for initiating informal classroom partnerships in their own communities.

Figure 1. Image of the article's authors. Figure shows the authors of this article preparing to present at the AMLE conference in Minneapolis.

The conference was held in Minneapolis, Minnesota in November 2013. The speed learning session, entitled "Reading, Writing, and Fitness: A Sixth Grade Classroom Partnership," was a success, with a total of twelve conference participants attending the three consecutive presentations. In addition to disseminating information about the innovative classroom partnership, presenting at the AMLE Annual Conference – and attending the conference itself – provided an authentic professional experience for Megan, Alyssa, and Teresa, who later identified four reasons why pre-service and practicing teachers should present at professional conferences.

Four Reasons

1. *Increased confidence and motivation.* An evaluation of Project APPLE, one institution's effort to engage undergraduate teacher education majors in delivering professional presentations, revealed that delivering professional presentations increased pre-service teachers' confidence as presenters and motivated them to deepen and/or expand their research and dissemination of research (Sanchez, Olson-Pacheco, Grosso, & Hanley, 2008). Following the speed learning session, pre-service teacher Megan wrote, "After presenting at the AMLE Annual Conference, I feel more comfortable speaking in front of a group of peers or colleagues, and I believe this will translate to the classroom setting as well. I have come away from this experience with more notions for teaching as well as more confidence in my abilities." For Teresa, an experienced teacher, the conference provided a much-appreciated change of pace. She recalled returning from the conference "feeling very excited and empowered."

2. *Classroom applications.* Pre-service teachers in the Project APPLE evaluation also noted that delivering professional presentations provided opportunities to actively engage in collaborative learning experiences and long-term professional development (Sanchez et al., 2008). Both Megan and Alyssa shared that they returned from the AMLE Annual Conference with a plethora of ideas, strategies, and activities that they hope to incorporate into their future classrooms. Alyssa summarized, "As a pre-service teacher, this opportunity not only prepared me for the realities of the education field, but also made me excited to begin my teaching career." Even with 16 years of teaching experience, Teresa also returned from the conference with fresh ideas and information, especially in regard to classroom management.

3. *Connections with fellow professionals.* Although conventional wisdom supports the benefits of attending and presenting at professional conferences (Cherrstrom, 2012; Fineday, 2012), one common obstacle is obtaining adequate funding (Nagel, 2013). Cherrstrom (2012) suggests that conference and travel expenses become more palatable when conference-goers make connections during the conference by networking, seeking new knowledge, exchanging ideas, volunteering for upcoming projects, and taking time afterward to reflect and set goals. Opportunities to network and exchange ideas were particularly valued by pre-service teachers Megan and Alyssa. Megan noted, "We received feedback from educators around the country who had a wealth of similar experiences,

suggestions, and ideas to share." Alyssa added, "I enjoyed being able to participate in conversation with practicing teachers about ways to enhance and support student learning." Similarly, Teresa noted, "It was very motivating to learn and engage in discussions about new management strategies with various colleagues and presenters from across the nation."

4. *Reciprocal Support.* Despite many benefits, obtaining permission to attend a professional conference is not always easy. Jana, the university professor who coordinated the trip, learned that it is important to provide a strong rationale for conference attendance early in the planning process. "Having an accepted conference presentation proposal certainly helps!" she noted. "You need to clearly articulate the connection between your organization's knowledge requirements and the conference program," explains Doyle (2013, section 3). For the Bradley group, obtaining permission from Teresa's school district was the greatest challenge. With the idea of reciprocal support in mind, getting permission from the school district was accomplished by providing a detailed travel plan and rationale to Teresa's building principal soon after school started in August. The principal gladly approved two professional days and secured a substitute teacher to cover Teresa's classroom during her absence. Upon her return to Peoria, Teresa reciprocated by sharing highlights from the conference with her colleagues at Roosevelt. She recalled, "From Ruby Payne, I shared strategies on how to work with children of poverty. From Noah Salzman, I shared The Teacher Creed. And lastly, I shared some very unconventional behavior management strategies discussed by Jack Berckemeyer."

Closing Thoughts

Arranging for pre-service and practicing teachers to present at professional conferences requires a great deal of planning, but increased confidence and motivation, classroom applications, connections with fellow professionals, and reciprocal support make it well worth the effort. Planning for the AMLE Annual Conference began six months ahead of time with writing the presentation proposal. Once the proposal was accepted, a student travel grant was written, travel funding and authorization were secured, airline and hotel reservations were made, and conference registrations were purchased. Then, an outline for the speed learning session was drafted, and the co-presenters met three times to finalize and rehearse the presentation.

During the flight home, Teresa commented to Jana, "You just kept moving it forward until we had everything we needed to do it." Jana responded, "That's true, but I can see now why this is not something you do every year. It was a lot of work!" However, a few days later, when Jana shared the success of the AMLE speed learning session with a class that had recently completed a similar assignment, one student commented, "I appreciate that we are doing something [in class] that professionals do in the teaching world. It gives us practice in case we ever have the opportunity [to present at a professional conference]."

On second thought, maybe arranging for pre-service and practicing teachers to attend professional conferences IS something we need to do annually. As Megan expounded,

"Going to the AMLE conference wasn't an opportunity I expected to have during my time at Bradley. But now that I've had the real-world experience, I feel inspired. Attending professional conferences (and possibly giving presentations) is something I will definitely look into when I have a classroom of my own!"

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