

THE ACHIEVEMENT GAP: THE IMPACT OF
INCREASED ENGAGEMENT

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TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION.....	1
II. REVIEW OF LITERATURE.....	3
Genetic Model.....	3
Socioeconomic/Sociopathological Model	12
Influence of Schools	21
III. METHODOLOGY	30
Sample and participation Selection.....	30
Constructs	31
Measures	32
Procedure.....	32
IV. RESULTS	36
V. DISCUSSION	39
Limitations	40
Implications.....	41
Theoretical	41
Practical.....	41
Conclusions.....	42
REFERENCES	43

LIST OF TABLES

Table	Page
1	36
2	37
3	38

CHAPTER I

INTRODUCTION

The United States Department of Education's National Assessment of Educational Progress consistently reports African American and Hispanic children significantly lag behind their Asian-American and Caucasian counterparts in all academic areas. The fact that minority students are frequently overrepresented in Special Education and lower academic track programs gives credence to this finding. Misguidedly, discussions on the achievement gap tend to use the terms ability and achievement interchangeably as though they were the same construct. However, these constructs are unique and while there is evidence of cognitive ability's impact on academic achievement (Swanson & Beebe-Frankenberger, 2004; Evans, Floyd, McGrew, & Leforgee, 2002), cognitive ability is impacted by many environmental factors and cognitive ability in itself does not determine academic achievement. Academic achievement is greatly influenced by psychosocial factors including self-esteem, self-concept, parent investment, socio-economic status, work ethics, motivation, culture, and variables associated with minority status; for example, low teacher expectations and other pre-judgments from others based on minority status. The complexity of the problem increases with the synergistic effects of these variables as well as with the influence of latent variables. This complexity is reflected in the numerous explanations for the problem including reports of systemic, developmental, economic hardship, and psychological factors as the root of the problem (Gerardi, 2005; Gottfredson, 2000; Guinote, Brown, & Fiske, 2006; Naglieri, Rojahn, & Matto, 2007; Raver, Gershoff, & Aber, 2007).

Unfortunately, the majority of these studies are correlational in nature and many of the theories have not been tested with controlled experimental designs focused on testing the effectiveness of feasible solutions to the gap in achievement.

One purpose of this study is to address this limitation with the use of a controlled experimental design to compare students receiving an increase of academic engagement compared to students who did not receive an increase in academic engagement. Another purpose is to evaluate the impact of increased academic engagement on minorities versus Caucasians. This study has two research questions:

1. In a controlled experimental study, does an increase in engagement significantly increase math achievement scores?
2. In a controlled experimental study, does an increase in engagement impact minority and Caucasians' math scores in the same manner?

Based on these questions, two hypotheses emerged. First, increased engagement will produce a significant increase in math achievement scores. Second, minorities and Caucasians will have equivalent growth in math scores.

Three main models have emerged from research focused on the Achievement Gap. Singham (2005) labeled these models the Socioeconomic Model, Sociopathological Model, and the Genetic Model. An analysis of each model is presented in this literature review. In addition, the role the American school system plays in contributing to the gap is discussed. While the lag in achievement is present with Latinos, African American, and Native Americans; many of the studies have focused on the African American children. Therefore, this review will at times refer specifically to African Americans.

CHAPTER II

LITERATURE REVIEW

Genetic Model

The genetic model was heralded into the spotlight by Herrnstein and Murray (1994) with the publication of The Bell Curve: Intelligence and Class Structure. The authors spouted data, made a surface analysis of the problem, and concluded that African Americans were genetically inferior to Caucasians. These assertions were presented as factual and did not include a valid account of the nature of traditional IQ tests or of the impact of environmental elements on IQ scores. This book was later discredited (Singham, 2005) however, the nature vs. nurture debate is ongoing and literature reviews reveal there is still acceptance of the claims made by Herrnstein and Murray with the underlying theme of fundamental and innate differences between racial groups excluding environmental contribution to these differences. This train of thought ignores evidence which suggests otherwise from almost every field including Anthropology and Biology. For example, anthropological and genetic research tracing human evolution has found a common ancestry of modern humans originating in Africa (Horai, Hayasaka, Kondo, Tsugane, & Takahata, 1995; Thomson, Pritchard, Shen, Oefner, & Feldman, 2000). Support for this theory has been found on both maternal and paternal lineage in studies of Mitochondrial DNA (Horai et al.,1995) and studies of DNA sequence data of Y

chromosomes (Thomson et al., 2000). The fact that human beings share a common ancestry does not imply that ethnic differences do not exist, but these findings do support the idea that human beings are more alike than they are different and that variations among the groups stem from the interaction with the environment and not due to an existential creation of mankind. A look at the migration of Native American ancestors illustrates this point. Researchers have found Native American ancestors migrated from Asia to the Americas, but weather conditions impeded their travel and thus resulted in an impromptu settlement in Beringia for an extended period of time (Tamm et al., 2007). The experiences of these Asians while in Beringia resulted in genetic and cultural changes. Thus, a new racial and ethnic group developed. Therefore, while modern Native Americans are a different race and ethnic group from modern Asians, they are in fact the same people and the differences between the groups are due to the interaction with the environment. Evidence of this gene-environment interaction is also evident in current everyday experiences. Richerson and Boyd (2005) demonstrated this interaction with lactose tolerance. Their finding suggests environmental differences influence whether an individual may or may not carry a specific gene, in this case, the gene which allows for the digestion of the milk of animals. Apparently, societies which indoctrinate and use dairy products tend to have the highest percentage of individuals who are able to digest milk. Conversely, societies where consuming dairy products are not propagated, tend to have a large percentage of individuals who are not lactose tolerant. Consequently, genetic traits seem to adapt in response to environmental demand.

Another premise of the genetic model is that differences in brain size and brain volume produce higher intelligence for certain groups with reports of Asians and

Caucasians as having a higher brain volume than Hispanics and African Americans. However, findings measuring the correlation between brain volume and intelligence are inconsistent and a multitude of figures have been reported. The wide range of these figures is reflected in a recent meta-analysis (McDaniel, 2005) when the investigator compiled 37 correlations from in vivo brain studies with correlations ranging from 0.07 to 0.86. Witelson, Beresh, and Kigar (2006) reported the inconsistency in studies is partly due to the lack of control for confounding variables, but also due to the manner in which MRIs are used in these studies. Indeed, Steen, Hamer, and Liberman (2007) report Magnetic Resonance Imaging (MRI) may not be as dependable in measuring brain volume as is commonly believed and results may vary depending on the sample size utilized, whether the study was cross-sectional or longitudinal, and whether the health or physical environment of the individual was taken into account. For example, significant brain volume changes may occur due to dehydration (Steen, 2007). An alternative to MRIs was presented by Witelson et al. (2006). The researchers suggested that postmortem water displacement methods may be more accurate than MRIs in measuring brain volume and demonstrated this precision with a study of 100 postmortem brains for which cognitive assessments were administered prior to the participants' demise. Findings did not indicate a blanket correlation between volume and IQ, but instead suggested that many factors determined the relationship including: brain lateralization, age, sex, and the specific area of the brain measured. For example, the investigators found that right handed men had a significant correlation between cerebral volume and verbal ability, but not left handed men (Witelson et al., 2006). For these reasons, the true correlation between brain volume and IQ is ambiguous at best.

Another concern for these studies is that many brain volume studies are reporting high heritability estimates along with the assertion that the environment has little effect on intelligence due to the high heritability characteristic of the brain (Van Leeuwen et al., 2009) when in fact, there is evidence indicating heritability is moderated by socioeconomic status. Using model fit analyses, Turkheimer, Haley, Waldron, D'Onofrio and Gottesman (2003) assessed genotype, shared environment, and nonshared environment as a function of socioeconomic status and found for low income families environment was the main contributor to the variance in IQ. Whereas, for high income families genetics accounts for the variance. Additionally, Coefficients of Additive Genetic Variance (CVA) seem to be less influenced by environmental factors and therefore provides more information regarding a trait than heritability estimates (Miller & Penke, 2007). Miller & Penke's study suggested brain size has a much smaller CVA in comparison to other human traits under stabilizing selection. For example, the largest estimate of the CVA for total body weight is approximately six times that of the CVA for total brain volume. The results of the study suggested brain size is being stabilized to an average size instead of a larger size (Miller & Penke, 2007). The investigators discussed this trend may be due to birthing needs i.e. the need for the infant's head to fit through the mother's birth canal. An inordinately large head would preclude a smooth delivery of infants. This problem is demonstrated in sub-Saharan Africa where a large percentage of women die from child birth due to Cephalopelvic Disproportion (Buchmann & Libhaber, 2008), when the baby's head is too large to fit through the mother's pelvis ("Cephalopelvic Disproportion." Mosby's Medical, Nursing, & Allied Health

Dictionary). Thus, it is plausible that any difference in brain volume for Africans is nothing more than nature's way of ensuring the mother and child's safety.

Additionally, there is evidence indicating that cognitive development and intelligence are impacted by a multitude of environmental factors. An example of environmental influence on brain development comes from Grossman et al. (2003) review of the effects of experience on brain development which suggested an individual's experiences can alter dendrite and synaptic morphology. Buss, Davis, Muftuler, Head, and Sandman (2010) studied anxiety during gestation and found pregnancy anxiety significantly impacted the structure of the brain, specifically, gray matter volume which in turns impacts cognitive functioning. Evidence of the effect of environment on intelligence comes from Evans and Rosenbaum (2008) who assessed self-regulation of 97 predominately Caucasian middle school children. Self-regulation is often assessed on intelligence measures usually through tasks involving attention. Evans & Rosenbaum found lower income children not only achieved less, but also did not perform as well on tests of self-regulation. D'Angiulli, Herdman, Stapells, and Hertzman (2008) found that children from low income families had more difficulty than children from high income families with the ability to attend to relevant stimuli (selective attention). Brant et al. (2009) findings indicate the influence of heritability increases with age, but environment is a significant factor during the early years. Ardila, Rosselli, Matute, and Guajardo (2005) measured the effects of public vs. private schooling and parent's educational level on executive functioning and found significant effects for type of school and parent's education level on executive functioning performance.

Culture has also been implicated to influence psychological functioning. Richerson and Boyd (2005) posit that culture and genes have a reciprocal relationship and have been critical in genetic evolution. The authors provided an example of the significant changes in human anatomy due to technology advancements. Technological advances have made life increasingly easier for humans including the ability to obtain food. Since there is no longer a need to hunt large animals, the anatomy of human beings has evolved to smaller frames.

In addition to the many environmental influences on brain development, there is now evidence suggesting that total brain volume is less important to intelligence than other structures of the brain. Glascher et al. (2010) suggested that more important than total brain volume is the connections between the specific brain regions. The researchers first conducted a hierarchical factor analyses with the Wechsler Adult Intelligence Scales and found that the verbal subtests, Block Design, and the Arithmetic subtests on the WAIS contributed the most to general intelligence. The researchers then utilized voxel-based lesion-symptom mapping in 241 patients who exhibited brain lesions in an effort to isolate specific brain regions responsible for success on tasks which were found to be heavily loaded. Findings indicate lesions in the area responsible for transmitting information through various parts of the brain, white matter areas, is more responsible for general intelligence than total brain volume. Also, findings indicate that the communication branch associated with the specific regions for performing tasks involving verbal or working memory had the most impact on general intelligence. These finding discounts the theory of total brain volume as the main contributor of intelligence

and points to the transmission of information to the specific regions as having more significance.

Nevertheless, some authors continue to stress the importance of brain volume and have used correlational studies to make a variety of causal inferences. For example, J.P. Rushton, has spent over a decade publishing these types of studies. His more recent works have attempted to use brain size/volume in explaining life-history variables (Rushton, 2010). In this brief review, Rushton (2010) made causal inference from not only human studies, but also other species to conclude that racial differences in brain volume was the cause of everything from reproduction habits to developmental milestones in African Americans. In 2009, Rushton and Templer suggested darker skin color was the cause of violent crimes by having graduate students rate skin color from light to dark and then correlating those ratings with crime rates. Many of Rushton's works, however, are aimed towards comparing ethnic groups (Rushton, 2008; Rushton & Rushton, 2003). Several of his publications are literature reviews utilizing correlational studies to reiterate innate racial differences in brain structure and IQ (Rushton & Ankney, 2000; Rushton & Ankney, 2009; Rushton & Jensen, 2005). Incredibly, even with the numerous studies Rushton has conducted in this area, none of his studies have explored explanations other than inferior genetics for people who are from Africa or African descent. Questionably, Rushton's own words contradict his findings. For example, Rushton, Cvorovic, and Bons (2007) studied the IQ of Romanians in Serbia and came to some interesting conclusions. The authors found this population averaged an IQ of 70, similar to the IQ Rushton and Jensen (2005) reported to be the mean IQ of people from sub-Saharan Africa. The finding of a 70 IQ of Romanians contradicted Rushton's research

which reported Caucasians have higher intelligence resulting from higher brain volume. Rushton et al. (2007) excused this discrepancy by citing culture as the likely culprit for the discrepancy. For example, test attitudes which influences participants' motivation and perseverance to the various tasks were considered to be culture specific and understandingly varied from Western attitudes. The inappropriateness of using IQ tests on populations outside the norming group was also discussed along with the poor living conditions such as overcrowded homes, lack of intellectual stimulation and poor nutrition of the Roma children. Rushton et al. (2007) were very understanding and cautioned readers against applying too much meaning on the results of the study since the results more than likely greatly underestimated the abilities of these children. Confusedly, this understanding did not extend to accounts of the IQ of people in sub-Saharan Africa even though sub-Saharan Africa has many of the same living conditions found in Serbia. In sub-Saharan Africa poverty is prolific and almost half of the sub-Saharan children do not attend school. In addition to poverty; people living in this part of the world are also combating life threatening diseases; civil wars, and extreme weather conditions which has been disastrous for much of the population who survive from farming (Domatob, 1997; Mabogunje, 2007). Thus, if poor living conditions and culture is an explanation for the Roma children's performances on IQ tests developed by Westerners, the same explanation is also true for sub-Saharan Africans.

Another position worth considering is evidence of differing achievement in groups with very little genetic variance. For example Chinese people are reportedly high achievers. Rushton and colleagues have pointed to higher brain volume and head circumference and in turn genetics to explain this characteristic. However, there is a

great deal of genetic variance within groups and very little genetic variance between groups in China.

The Han population is China's majority ethnic group with a population of over one billion. The remaining population, approximately 100 million constitutes of 55 minority nationals. Similar to the United States of America, poverty is widespread in minority communities. In addition, China is dealing with a similar Achievement Gap between the majority and minority with high illiteracy and dropout rates (Clothey, 2005; Wang & Zhou, 2003). Fascinatingly, unlike America, race and ethnicity are not divided by skin color. In China, visible minorities do not exist. Ethnicity is based on history, cultural traditions, and linguistic heritages (Bass, 2005; Kayongo-Male & Lee, 2004). Yet, as previously mentioned, minorities achieve less than the majority. To combat this problem, the government has intervened in a similar manner to the U.S. including affirmative action policies and research studies attempting to find an answer to this problem. Results of some of these studies indicate minority status, specifically consequences of minority status including lower socioeconomic status and ethnic identity, significantly impacts minority achievement (Bass, 2005). Other studies have attempted to determine the degree of genetic similarity between the majority and minority groups and the degree of variance within the populations. Chu et al. (1998) studied 28 populations living in China including 4 Han populations and 24 minority nationals. DNA samples were collected and phylogeny analyses based on microsatellites were conducted. Findings reveal little genetic variance between the Han population and Minority Nationals. Oota et al. (2002) conducted a genetic analysis, PCR amplification, and Phylogenic analyses to compare two Han Chinese populations, Japanese population, and

Vietnamese population and found high genetic variance within each of these populations, but little variance between the groups. These studies indicate that achievement varies even when there is little genetic variation between populations.

Socioeconomic / Sociopathological Model

Socioeconomic status has a powerful influence on the psychosocial factors which formulate the Sociopathological Model. Therefore, these two models are reviewed simultaneously.

The United States of America has the status as one of the most powerful, developed nations in the world, yet many children are living in poverty in the U.S. More than thirteen million children are estimated to be living below the poverty line (Census, 2008). Even worse, only the cost of food is used in making the determination for the poverty cut-off. Since the cost of housing and other expenses are not considered, the number of children reported to be living below the poverty line is more than likely underestimated according to the National Center for Children in poverty. Additionally, economic equality is still an abstract concept in America and minority groups continue to experience higher levels of poverty than the majority (Raver, Aber, & Gershoff, 2007). Evidence of this discrepancy was reported by United for a Fair Economy (UFE), a nonprofit organization. UFE's report, *The State of the Dream*, reported the median net worth of a Black household in 2001 was \$19,000 whereas the median net worth for a Caucasian household was \$121,000. Additionally, more and more studies are revealing socioeconomic status has a significant impact on neurocognitive systems, cognitive development, and specific cognitive skills.

The impact of SES on the areas of the brain responsible for language and memory is revealed in a study conducted by Farah et al. (2006). In this study, 60 African-American children (30 low income and 30 middle income boys and girls) were given a battery of tests to evaluate their neurocognitive functioning. The key neurocognitive systems assessed included the Lateral prefrontal cortex-Working Memory, Anterior cingulate cortex-Cognitive Control System, Ventromedial prefrontal cortex-Reward System, Occipito-temporal/ Pattern Vision system, Parietal/ Spatial Cognition system, Left Perisylvian/ Language system, and the Medial temporal/ Memory System. The authors reasoning for measuring several areas of the prefrontal cortex was due to the continued development of this area after birth and due to the association of the executive functioning in this area with generalized intelligence (Farah et al., 2006). A statistical analysis (Multivariate Analysis of Covariance) resulted in statistically significant effects for SES. Participants with higher SES outperformed the lower SES group. A statistically significant interaction effect for SES and Neurocognitive systems was also found indicating SES impacted some neurocognitive systems more than others. Specifically, the Left perisylvian/ Language System and the Medial temporal/ Memory system were most impacted. In addition, the Lateral prefrontal cortex- Working Memory System was also impacted.

Another study which supported the Socioeconomic Model was conducted by Noble, Wolmetz, Ochs, Farah, and McCandliss (2006). This study utilized Functional Magnetic Resonance Imaging (fMRI) to capture brain activation during certain reading tasks. Participants included first-third grade students in a socioeconomically and racially diverse group in New York City. The participants had varying reading abilities, but all

had below average phonological awareness skills. The fMRI analysis revealed that for children with low SES, the Left perisylvian region (the area responsible for phonological processing) was activated, but for children with a higher SES it was not, indicating that low income children depended on phonetic skills while the higher income children were not dependent on this skill. Additionally children in the higher SES category had stronger reading ability than children from the lower SES category. In other words, children in the high SES category managed to become good readers despite having poor phonetic awareness, but children in the low SES category could not compensate for the phonological deficits. This finding indicates that children with low SES are more dependent on the actual mechanics of reading whereas children from higher SES utilize sight reading to compensate for low phonetic awareness skills. The ability of the children in the high SES group to compensate is likely due to having access to print materials in the home environment. Thus, these children seem to be learning to read from whole word recognition as opposed to phonetic analysis. Therefore, the lack of phonetic skills is not detrimental for this group. This study is especially enlightening since the sample used for the study was a racially diverse sample, suggesting SES not race/ethnicity, was the key variable in reading achievement.

The previous studies discussed provided support for the Socioeconomic Model in regards to influencing neurocognitive systems and cognitive skills. There is also evidence that poverty or low SES impacts brain maturation. Otero (1997) utilized Electroencephalography (EEG) to demonstrate this phenomenon.

Participants of this study included forty-two, 4-year-olds (20 boys and 22 girls) in Toluca, Mexico. The children were classified as high risk children (low SES) or low risk

children (middle-middle high income). The children underwent ten minutes of EEG recording while they were awake and the absolute power for four frequency bands were obtained along with the total EEG energy ranging from 1.5 to 19 Hz. An ANOVA analysis compared the groups. The effects for risk, sex, as well as the interaction between the two factors were analyzed. SES was the only statistically significant effect. Children in the low SES group demonstrated more delta and theta power in the frontal regions indicating slower brain activity. Otero (1996) regarded this results as evidence of a maturational lag for children with low SES. Interestingly, these same children's EEG was evaluated in a previous study at the ages of 18 and 30 months. The results were similar to the results found at 4 years of age. The analyses of the two groups (low and middle income) of the same ethnicity reveal the impact of SES on children's brain development.

In addition to neurocognitive functions and cognitive ability, SES also impact psychosocial development which is at the core of The Sociopathological Model. The Sociopathological Model is characterized by unstable families, lack of solid work ethics, poor parenting, lack of drive and ambition, drugs, and high crime rates in the minority communities (Singham, 2005). Proponents of this model imply the achievement gap of minority children is due to character flaws of minorities. A major tenet of the Sociopathological Model is with the parenting practices of minorities. Some studies have reported African American parents utilize harsh parenting, are uninvolved, and less attached to their children. However, studies analyzing the impact of economic hardship on families of various ethnic groups offer evidence that the characteristics which are

touted as being unique to minorities are symptoms of economic pressure and these characteristics are also demonstrated in Caucasian families under economic stress.

One such study is the seminal work of Conger et al. (1992) who explored the impact of economic hardship on families by analyzing the behaviors and moods of white, rural families experiencing financial stress due to an agricultural crisis in the 80s. The investigators proposed a model for explaining the impact of economic hardship on family functioning. This model, later named The Family Stress Model, was based on the premise that family economic pressure as defined by family income, unstable work, debts to assets, and income loss translates to demoralization and depressed moods which impact parenting behaviors and in turn adjustment of adolescents. The researchers utilized multiple methods and sources for measuring the various constructs including: interviews, home visits, and video recordings of family interaction, mood questionnaires, and observations. Structural equation modeling was utilized to test the model. The researchers found support for The Family Stress Model suggesting economic hardship impacts parents' moods and in turn the ability to provide warm/involved parenting. This impact on parenting behaviors affected adolescent's school performance, peer relations, and self confidence.

The Family Stress Model has also been validated with Caucasian families outside the United States of America. Leinonen, Solantaus, and Punamaki (2002) demonstrated the effects of economic stress by studying families in Finland who were experiencing a financial crisis. In addition to depressed moods of parent, the investigators explored whether economic hardship produces anxiety and social dysfunction in parents. The authors utilized a path analysis to analyze the model. Support was found for the

influence of economic hardship on parenting through economic pressure, parent's mental health, and marital interaction. In addition to supporting The Family Stress Model, this study found that economic pressures impacted the mental health of mothers and fathers differently. Mothers experienced anxiety and depression leading to uninvolved and less authoritative parenting. Fathers, on the other hand, experienced anxiety and social dysfunction which led to punitive and uninvolved parenting practices. Most important, was the finding that economic pressure impacts family functioning even when the family's income is above poverty range supporting the hypothesis that it is not income per se, but financial pressures which impacts parents and in turn children's functioning. Additionally, the finding demonstrated that families whose income is not in the poverty range may have a lower threshold for financial stress. This line of reasoning would indicate families experiencing chronic poverty would likely demonstrate a higher threshold for financial stress and may be a possible explanation for the increasing reports (Barnett, 2008) of less depressed moods for African American parents.

For minorities, The Family Stress Model has also been validated empirically as a legitimate model for explaining the adjustment of children through the impact of parents' moods and behaviors, possibly by impacting parent's sensitivity to their children's needs (Bakermans-Kranenburg et al., 2004).

For example, Conger et al. (2002) expanded the model to two-caregiver African American families in rural and suburban areas and found similar findings that children's adjustment is impacted by the mediating variables of economic hardship. Scaramella et al. (2008) evaluated the adjustment of toddlers after Hurricane Katrina and also found support for applying The Family Stress Model to African American families. In keeping

with the model, the authors tested financial strain using an income-to-needs ratio. Utilizing an income-to-needs ratio ensured that financial pressure and not income was the contributing factor for parents' moods. Structural Equation Modeling analyzed the model. Findings validated The Family Stress Model's usefulness in explaining adjustment in toddlers suggesting once again the influence financial strain has on parenting and children's adjustment. Support was also found for the hypothesis that neighborhood violence and the number of adults in the home impacted parents' moods.

Parke et al. (2004) expanded the model to urban families with varying income level and included a sample of Mexican American families. In observance of cultural factors, the model was also expanded to measure levels of acculturation as a mediating factor for Mexican American families. The investigators theorized that higher levels of acculturation would be associated with higher levels of income and thus less financial pressure for parents. In addition to expanding the model, the investigators measured hostile parenting as measured by hostile/rejecting and passive/inconsistent behaviors instead of nurturing/involved parenting in Conger et al. (2002)'s study. Support was found for low levels of acculturation as a mediating factor for Mexican American families as well as efficaciousness of the model for explaining the impact of hardship on Mexican American families.

Some studies have focused on mediating factors other than family process in explaining the impact of poverty or economic hardship. For example, Guo and Harris (2000) conducted a factor analysis with data obtained from the National Longitudinal Survey of Youth Data (NLSY) and obtained several mediating factors for their theoretical model. Guo and Harris (2000)'s model held that family poverty per se does not impact

children's development, but poverty impacts the factors which are responsible for children's development. These factors include the physical environment of the home, mother's involvement with the child, cognitive stimulation at home, the child's health, and child care quality. Structural equation models were used for analysis of the model. The authors found support for their hypothesis that poverty impacts the mediating factors of children's development. A positive aspect of this study is the use of NLSY data which included an oversampling of African American, Hispanic, and disadvantaged Caucasian families, since support for this theory was found for each of these groups.

The findings of these studies which provide evidence for The Family Stress Model for both Caucasians and minorities, demonstrate that factors suggested by proponents of the Sociopathological Model to be unique to minority groups are actually symptomatic of economic hardship and is present in Caucasian families experiencing similar conditions.

Additional evidence for the role of economic hardship comes from a study of rural white children. Rural Caucasian children also face a disproportionate amount of poverty (Evans & English, 2002; Tickamyer & Duncan, 1990) and there is evidence that these children lag behind their nonrural Caucasian counterparts in school readiness upon entering Kindergarten. The National Center for Rural Early Childhood Learning Initiatives reported a significant lag in letter recognition and identifying the beginning of sounds for rural Caucasian children. Although rural Caucasian children enter Kindergarten with a lag in achievement, minority children are still at a disadvantage when compared to this group. According to the National Center for Rural Early

Childhood, 13.6% of rural Black children participated in early education programs prior to Kindergarten compared to 35.3% for Caucasian rural children (Grace et al., 2006).

Although support for the stress model suggests that economic hardship impacts children's development through various mediating factors for all ethnic groups, ethnic groups do not experience poverty in the same manner. Evidence for this difference was found in tests of model equivalence and mediation conducted by Raver, Gershoff, and Aber (2007) who found material hardship i.e. food insecurity, inadequate medical care, and residential instability resulted in greater levels of stress for Black families which in turn resulted in impacted parenting practices. Mimura (2008) obtained hardship scores for low income Caucasian, African American, and Hispanic families. Scores obtained revealed that African American families spent a greater percentage of their income on housing costs and experienced the greatest amount of hardship. Drake and Rank (2009) conducted an analysis of U.S. census to determine the percentage of children living below the poverty line who were also living in high poverty neighborhoods and found that poor Black and Hispanic children are significantly more likely to live in neighborhoods with a high percentage of children living in poverty compared to poor white children. Further Blacks and Hispanics were less likely to live in racially diverse neighborhoods. This isolation is reminiscent of Separate but Equal Laws which ended almost 60 years ago. At that time, Separate but Equal was a law, in current times the force which maintains this structure is economic status. Unfortunately, separate was not equal then or now. Children in disadvantaged neighborhood are more likely to have many more stressors and experience a greater disadvantage than poor children not living in a high poverty neighborhood. Their physical environment is characterized by

increased noise levels, increased street traffic, exposure to toxic fumes, and increased crime (Evans, 2004; Caspi et al., 2000). Kohen et al. (2008) utilized The Family Stress Model to analyze neighborhood theories for explaining children's developmental outcomes. The investigators utilized data from the Canadian National Longitudinal Survey of Children and Youth and adapted The Family Stress Model by replacing economic hardship with Neighborhood SES. The mediating factors evaluated were neighborhood cohesion, family functioning, maternal depression, literacy, consistent parenting, and punitive parenting. Children's verbal ability and problem behaviors were the measured outcomes. Structural equation modeling analyzed the model and found support for the model indicating low SES neighborhoods leads to lower neighborhood cohesion, parental depression, altered family functioning, which in turn impacted literacy in the home and children's verbal ability and increased the presence of problem behaviors.

Influence of Schools

It would be remiss to discuss the Achievement Gap without discussing the role schools play in the equation. On average, children spend 40 hours a week in school (Hallinan, 2008) and one could argue that since achievement is typically measured with mastery of school curriculum, the school system holds most of the responsibility for the acquisition of these skills.

In 1981, Secretary of Education, Honorable T.H. Bell formed the National Commission on Excellence in Education to assess the American education system. By 1983, the commission presented a report, *A Nation at Risk*, and brought to the attention

of stakeholders the poor state of children's education in America including high rates of functional illiteracy among 17-year-olds (U.S. Department of Education, 1983) suggesting the school system was failing in their responsibility to educate children. In response to the many problems in the school system, President George H.W. Bush signed into law No Child Left Behind (NCLB) with requirements of accountability and highly qualified teachers (No Child Left Behind [NCLB], 2002). However, the law has not been effective in increasing student achievement and although credit is given to NCLB for the accountability measures which provides data for assessing children's achievement, (U.S. Department of Education, 2008) this very data highlights the lack of progress in education. For example, the Department of Education (2008) reports the achievement of 17-year-olds has not improved in over two decades and suggested the nation is more at risk now than it was in the eighties. A possible reason for the ineffectiveness of No Child Left Behind is the limited scope in focusing on teacher qualifications instead of the effectiveness of teachers. No doubt, teacher qualifications are important and a number of studies within the last decade verify this importance (Ascher & Fruchter, 2001; Clotfelter, Ladd, & Vigdor, 2007; Heck, 2007; Konstantopoulos, 2009). However, the findings of some studies suggest that teacher qualifications in itself is not sufficient for student achievement (Munoz & Chang, 2007; Stronge et al., 2007; Xin, 2004; Smith, 2008) and a closer look at teacher effectiveness is necessary. For this reason, the use of Value-Added Modeling (VAM) for evaluating teacher effectiveness is becoming more common. VAM incorporates multiple variables into a general linear equation and seems to provide a valid measure of teacher effectiveness by controlling for background characteristics which impact children's achievement (Lockwood, 2004; Murnane &

Steele, 2007; Konstantopoulos, 2009). This evaluation method provides strong evidence that the effectiveness of teachers is critical. More relevant to the achievement gap are the studies which report that teacher effects are stronger with children living in poverty (Nye et al., 2004). This finding may be due to the fact that these children have fewer resources at home and therefore, the school environment may play a more pronounced role in their development. Despite the evidence that teacher effectiveness make the most impact on minority youth living in poverty, some studies have reported that these children often get the least qualified and least effective teachers (Jacob, 2007; Hill, 2007; Stichter, Stormont, & Lewis, 2009). Studies are citing lower parent involvement, more problem behaviors, lower salaries, and poorer work conditions in high minority low socioeconomic schools districts as the basis for this inequity (Jacob, 2007; Murnane & Steele, 2007).

Effective instructional practices.

Although studies are indicating teacher effectiveness is the key to high achievement, the specific instructional practices which are most effective are not as straightforward. For example, The Handbook of Research on Improving Student Achievement outlines general as well as content area classroom practices which have been validated through research to be most effective in achievement gains (Cawelti, 2004). Yet there is very little crossover of the general practices and content area practices. There is also very little crossover between content area practices. Therefore, the general practices which are said to be effective are not the same practices which are suggested in the individual subject areas. Additionally, instructional practices which are found to be effective for math may not be the same instructional practices which are

effective for reading. Nevertheless, practices which are mentioned again and again in the literature as being the most effective are practices which include high expectations and ample opportunities for learning with high levels of student engagement.

Teacher expectations.

While teacher expectations are not specific behaviors, teacher expectations do influence teacher behaviors and in turn impact student achievement. This line of research stemmed from Merton (1948) who introduced the self-fulfilling prophecy. Later, the self-fulfilling prophecy was tested by Rosenthal and Jacobson (1968) in which teachers were led to believe their students were being tested with a Harvard test which would predict future bloomers, but were in fact being tested with a nonverbal intelligence test which was later readministered to measure gains in IQ. The investigators randomly chose students labeled as late bloomers and provided the names of these students to the teachers. Significant gains in IQ were reported for the experimental group (late bloomers) compared to the control group when the students were retested a year later. Findings of this study suggested that teacher expectations impacted IQ scores (Rosenthal & Jacobson, 1968). The study sparked a controversy on the legitimacy of the self-fulfilling prophecy and the impact of teacher expectations on children in the classroom (Jussim & Harber, 2005) and many attempts were made to confirm or disconfirm the findings. Results over the years have been inconsistent, but meta-analyses of the studies on this topic have found that the self-fulfilling prophecy is legitimate (Jussim & Harber,

2005; Tenenbaum & Ruck, 2007; Kierein & Gold, 2000). In order to address the inconsistency in findings across studies, some investigators have included an analysis of mediators and or moderators as an explanation for the varying results and effect sizes found in the literature. For example, Kuklinski and Weinstein (2001) obtained a subsample from a longitudinal study of teacher expectations conducted by the National Institute of Mental Health in order to evaluate developmental differences and children's perceived differential treatment as a moderator of teacher expectancy effects on reading achievement. Children's self-expectation of achievement was also evaluated as a mediator of teacher expectations and achievement. The authors hypothesized that if there were obvious cues of the expectations, teacher expectations would directly impact not only children's expectation of themselves, but also ending achievement. Findings suggested that not only did teacher expectations indirectly impact student achievement through its influence on children's self-expectations, there was also a direct impact on achievement. Other studies examining moderators and mediators have expanded the concept to include parental influence including: parent involvement as a mediator for teacher expectations (Kuperminc, Darnell, Alvarez-Jimenez, 2008) and the simultaneous effects of parent and teacher expectations (Mistry, White, Benner, & Huynh, 2009). Parental involvement was found to influence teacher expectations (Kuperminc et. al., 2008), but both studies found support for teacher expectations leading to higher achievement. Another study demonstrating the influence of moderators and mediators on the self-fulfilling prophecy was conducted by Hinnant, O'Brien, and Ghazarian (2009). These investigators utilized the National Institute of Child Health and Human Development (NICHD)'s longitudinal study of Early Child Care and Youth Development

to determine whether overestimation or underestimation of children's abilities at school entry would impact future school performance. Regression methods were utilized in order to obtain a teacher expectancy score based on teachers' ratings of children's abilities in reading and math versus their actual performance in these areas as measured by the Woodcock Johnson Tests of Achievement. Hierarchical regression methods were used to test the effects of the moderators including demographics and social competence on teacher expectancy scores and to determine whether expectancy scores in earlier grades would predict achievement at later grades. Results indicated teacher's inaccurate estimation of student's abilities predicted achievement. In addition, ethnicity and income was a significant moderator for the relationship between teacher expectancy and achievement suggesting a stronger relationship between teacher expectation and achievement for low income minority children than for high income Caucasian children. The greater impact of teacher expectations on minorities is also demonstrated in other studies. For example, Hinnant et al. (2009) found that the performance of minority males varied more significantly in relation to teacher expectations with lower expectations predicting less achievement and higher expectations predicting higher achievement in later grades. Tenenbaum & Ruck's (2007) meta-analysis which compared teacher behaviors and teacher's speech patterns with European Americans and minority youth found positive expectations, teacher's speech, and teacher's behaviors favored European Americans. Another example, Marcus et al. (1991) evaluated black and white student perceptions of teacher treatment and found that even when black and white students demonstrated similar achievement levels, black males perceived differential expectations and reported teachers expected less from them, gave them fewer choices and called on

them less. Thus, minority children may be more impacted by teacher expectations than Caucasian children (Casteel, 1997; Marcus, Gross, & Seefeldt, 1991; Hinnant, O’Brein, & Ghazarian, 2009; Reyna, 2008; Tenenbaum, 2007).

Student engagement.

The importance of time allotted for learning has been documented (Allington, 2002; Cawelti, 2004) and at least one study has demonstrated low levels of actual instruction time in high minority urban areas (Smith, 2000). However, student engagement during the time allotments appears to be even more significant to achievement than time alone. Thus, researchers have explored engagement extensively and extant studies reveal engagement is a complex construct with many interrelated factors including behavioral, emotional, and cognitive components. This complexity has led to the construct being defined and measured in a multitude of ways. For example, studies have analyzed classroom engagement, school engagement, engagement as a unidimensional construct, and engagement as a multidimensional construct (Fredricks, Blumenfeld, Paris, 2004; Marks, 2000; Strambler & Weinstein, 2010). Despite this complexity, many studies have reported the positive relationship between student engagement and achievement (Bodovski & Farkas, 2007; Finn & Rock, 1997; Fredricks et al., 2004; Gardner, 1994; Huges & Kwok, 2007; Huges, Luo, Kwok, Loyd, 2008; Luo, Huges, Liew, & Kwok, 2009; Pointz, Rimm-Kaufman, Grimm, Curby, 2009; Ripski & Gregory, 2009; Sciarra & Seirup, 2008; Sterling, Barbetta, Heward, & Heron, 1997; You & Sharkey, 2009). More important, minority children benefit significantly when high levels of engagement are present (Bodovski & Farkas, 2007) indicating that engagement may be a critical component in closing the Achievement Gap. Finn and Rock (1997), for example,

compared at-risk minority groups' achievement in relation to engagement and demonstrated that minority children do vary in achievement based on levels of school engagement. The authors utilized longitudinal data to measure school engagement in relation to academic achievement and found the key variable attributing to the various levels of achievement demonstrated by these students was student engagement. This study focus was on school engagement as opposed to active engagement during instruction and while the finding that minority students' achievement varies with school engagement; a look at active engagement during instruction is critical. This type of engagement, behavioral engagement, pertains to observable participation in classroom instruction and activities and is more frequently associated with student achievement (Glanville, 2007; Sterling, 1997). In turn, classroom quality and teacher effectiveness predicts this type of engagement (Lan et al., 2009; Raphael, 2008) and thus may be the most direct path to closing the achievement gap. For example, Gardner (1994) found choice of instructional method produces higher levels of active engagement. The investigator found the use of response cards produced higher levels of active student responses than hand raising and students using these response cards achieved higher scores on review test than the group instructed with hand raising. Heward (1994) placed active student responses at the center of a learning trial model which included an antecedent prompting the student's response and feedback following the response. The number of learning trials was implicated as a measure of teacher effectiveness. Despite the importance of active student responses, however, students spend the majority of their school day passively attending and not actively responding to instruction (Heward, 1994). Comparative studies give credibility to this claim. Lan (2009) compared the United States

to China in levels of behavioral engagement during math lessons and found Chinese students were engaged 96% of the intervals observed compared to American students who were engaged 61% of the intervals. The quality of American children's engagement has also come into question. Hiebert et al. (2005) study found in comparison to Australia, Czech Republic, Hong Kong SAR, Japan, Netherlands, and Switzerland, students in the United States spent significantly less time in more challenging math activities. Dow (2007) supported this finding in his study of Puerto Rican girls' time spent in school. Through direct observations of the classrooms, this investigator found the majority of tasks completed by these students were tasks involving low level thinking including rote memorization.

The studies reviewed in the above section provide strong evidence for the positive effects of student engagement on achievement for all students. None of these studies, however, have measured increased levels of engagement in controlled experimental designs with randomization and control groups to determine the impact on student achievement or as a solution to The Achievement Gap.

CHAPTER III

METHODS

Sample and Participant Selection

Sixty-six fifth grade students in an elementary school in the south central region of the United States were recruited for this study. Over 97% of the student population qualified for free or reduced price lunch.

Recruitment occurred following Oklahoma State University's Institutional Review Board's approval of the study from January 10, 2011 through March 4, 2011. The investigator provided a brief description of the study to the students and informed the students that the permission forms would be sent home in their take home folders for their parents. A raffle for a \$25.00 gift card to a local restaurant served as an incentive to return the permission forms.

The intended sample size was a minimum of 48 students; 24 students in the treatment condition and 24 students in the control condition, $n = 12$ in order to ensure the normality assumption for the ANOVA analysis. Fifty permission forms were returned and included two parent declines. The investigator read assent forms to the 48 students and asked them to sign the forms if they were willing to participate in the study. All 48

students assented to participate in the study. However, four students were withdrawn from the study for various reasons including special education status, home school status, and school suspensions. Therefore, 44 participants ages 10-12 participated in this study. Participants included 23% African Americans, 45% Caucasians, 5% Hispanics, and 27% Native Americans. The sample included 24 females and 20 males.

Constructs

Independent variables.

This study consisted of two independent variables, engagement and ethnic status. Engagement is defined in this study as active student responses to math application questions. Students were provided with an increased opportunity to actively respond through the use of response boards and choral responding. These opportunities to respond followed the learning trial model in which an instructional antecedent in the form of questioning was provided along with feedback from peers and the principal investigator following the response (Heward, 1994). The second independent variable was Ethnic Status. Students were grouped either as a minority or Caucasian based on school records of their ethnicity.

Dependent variables.

Two pretests were administered: The WJIII, Applied Math Subtest (Form A) and The Monitoring Basic Skills Progress (Test One).

Two posttests were administered: The WJIII, Applied Math Subtest (form B) and The Monitoring Basic Skills Progress (Test five).

Measures

The Woodcock Johnson III Tests of Achievement are individually administered norm-referenced tests of Reading, Math, Oral Language, and Written Language. The Applied Problems subtest was utilized for this study. A median reliability of .92 is reported in the examiner's manual for this subtest (Mather & Woodcock, 2001).

The Monitoring Basic Skills Progress (MBSP) Basic Math tests are group administered, curriculum-based measurements composed of math computation, concepts, and application problems for first through sixth grades. The 5th grade Concepts and Applications tests were utilized in this study. Test-Retest reliability of .75 for fifth grade students without disabilities is reported in the manual (Fuchs, Hamlett, & Fuchs, 1999).

Both tests were administered by the principal investigator who has had graduate-level training and experience in administering and scoring norm-referenced tests and curriculum-based measurements. Difference scores between the pre and posttests were obtained and all data were entered into a statistical package (SPSS 18) for analyses.

Procedure

Group assignment.

Participating students were divided into two categories: Caucasians and minorities based on school records of their ethnic status. The investigator then randomly assigned

the Caucasian students into the treatment and control group and then randomly assigned the minority students into the treatment and control groups.

Classroom structure.

The fifth grade students participate in three (85 minutes) blocks of instruction for each subject area. Each fifth grade teacher is assigned to teach one subject. This study was conducted during the three math blocks of instruction. The classroom teacher reported the structure of her classroom is composed of whole group instruction for the first part of class and independent practice towards the second half of class. Students generally finish their assignments with 30 minutes to spare. Thus, the study took place within that 30 minute time frame.

Treatment condition.

The students in the treatment condition participated in 30 minute sessions during the school day for three weeks (15 days). The sessions were administered in the hall in a section previously used for enrichment. Students sat on the floor in a half circle around the experimenter. During these sessions, the principal investigator read math problems and students responded using dry erase boards.

The first day of the study was considered training day. On training day, students were provided with rules for the sessions including instructions for “Ready Position”. Ready position was a cue to the students to place the dry erase boards on their lap with the markers on the boards. This position was also a cue for silence. Students were asked to assume Ready Position if they completed working before time was up and to demonstrate they were prepared for the next question. The “What’s the answer?” cue

was also introduced to the students at this time. This cue was given after the math problem was read and was a cue to begin solving and to write the answer on the dry erase board. The “time” cue was given when time was up and cued the students to hold up their answer. During this training, the use of the response boards were modeled and students practiced using the boards and responding to the cues.

An attempt was made to keep each trial (time allowed to respond) 40 to 60 seconds in length. However, the students were allowed to continue working after 60 seconds if they were actively working. This flexibility with the time limit was to avoid the students becoming frustrated from having to stop midway in completing the problem. After time was called, the experimenter stated, “The correct answer is ___;” and “Class” indicating a choral response was needed. Students were then encouraged to look at their peers’ responses. Additional feedback was provided by peers and by the principal investigator. For example, a peer with a correct answer was asked to share with the group his or her strategy for solving the problem. If none of the students produced a correct answer, feedback and modeling were provided by the principal investigator. Items which resulted in a large number of errors were reintroduced at a later trial. If the students continued to have difficulty with the problem, additional problems on a lower level were utilized for remediation.

Majority of the math questions were obtained from a Macmillan McGraw-Hill 4th grade level text book and a Harcourt Brace fifth grade level textbook. However, third grade level questions were utilized based on demonstrated difficulty with the problems (high number of errors) and some of the problems/questions were obtained from internet sites.

Control condition.

The students in the control condition were instructed to remain in the classroom with the classroom teacher. The students were asked read a book of their choice during the time the principal investigator worked with the treatment condition. The classroom teacher monitored this activity.

CHAPTER IV

RESULTS

Data in the current study were analyzed with 2 two-factor between subjects analysis of variance (ANOVA) for independent groups. Levene's Test of Equality of Error Variance verified the homogeneity of variance assumption was met for both analyses. A specification table is reflected in Table One. The study's sample size, $N = 44$ and alpha level, $p < .05$ provides sufficient power to detect significant effects.

Table 1

Independent Variables	Levels
Ethnic Status	2
Engagement	2

The first analysis measured the effect of group (increased engagement, no increase of engagement) and ethnic status (minority, Caucasian) on mean difference between pre and posttests on the Woodcock Johnson III Applied Problem subtest (raw scores). Descriptive statistics for this dependent variable are reflected in Table Two. The ANOVA revealed that the interaction of group condition and ethnic status condition was not significant, $F(1, 40) = .004$, $p = .95$, partial $\eta^2 = 0$. Additionally, the main effect

of ethnicity was not significant, $F(1, 40) = .032$, $p = .86$, partial $\eta^2 = 0$. Result of the ANOVA, however, do indicate a significant main effect for group condition, $F(1, 40) = 5.59$, $p = .02$, partial $\eta^2 = .12$. Calculation of Cohen's d reveals a medium effect of -0.7 (Keppel & Wickens, 2004).

Table 2

Descriptive Statistics for Raw Score Difference between Pre and Post Tests on the WJIII Applied Math Subtest

Ethnic Status	Group	Mean	Standard Deviation	Number of Participants
Minority	No increase of engagement	-.30	3.13	10
	Increased engagement	.2	3.31	14
	Total	1.04	3.37	24
Caucasian	No increase of engagement	-.55	3.45	11
	Increased engagement	1.89	3.18	9
	Total	.55	3.47	20
Total	No increase of engagement	-.43	3.22	21
	Increased engagement	1.96	3.18	23
	Total	.82	3.38	44

The second analysis measured the effect of group (increased engagement, no increase of engagement) and ethnic status (minority, Caucasian) on mean difference between pre and posttests of The Monitoring Basic Skills Progress (curriculum-based measurement).

Descriptive statistics for this dependent variable are reflected in Table Three. The ANOVA revealed there were not any significant mean difference for the group condition $F(1, 40) = .17, p = .68, \text{partial } \eta^2 = 0$; ethnic status condition $F(1, 40) = .01, p = .92, \text{partial } \eta^2 = 0$; or the combination of those variables $F(1, 40) = 0, p = .97, \text{partial } \eta^2 = 0$; on mean score difference on the MBSP.

Table 3

Descriptive Statistics for Difference between Pre and Post Tests on The Monitoring Basic Skills Progress (CBM)

Ethnic Status	Group	Mean	Standard Deviation	Number of Participants
Minority	No increase of engagement	2.40	5.19	10
	Increased engagement	1.79	4.84	14
	Total	2.04	4.89	24
Caucasian	No increase of engagement	2.64	5.37	11
	Increased engagement	1.89	6.25	9
	Total	2.30	5.64	20
Total	No increase of engagement	2.52	5.15	21
	Increased engagement	1.83	5.30	23
	Total	2.16	5.18	44

CHAPTER V

DISCUSSION

In a controlled experimental study, does an increase in engagement significantly increase math achievement scores? The results of the first analysis with the WJIII Applied Problems subtest as the dependent variable supports the hypothesis that an increase of engagement would significantly increase applied math scores. Remarkably, this growth was made after only 14-30 minute sessions of increased engagement.

The second analysis, using a curriculum-based measurement, as the dependent variable did not support the hypothesis. The lack of significant growth on the fifth grade level CBM is logical since some students math skills were below grade level. Thus, math questions utilized during the treatment condition ranged from third to fifth grade level depending on demonstrated difficulty with the problems. Since the curriculum-based measurement is a measure of fifth grade curriculum, the CBM would not be sensitive enough to show growth of students working below grade level. The WJIII Tests of Achievement, however, is a measure of academic achievement from prekindergarten to university level and therefore was sensitive enough to capture the growth of functioning below grade level.

In a controlled experimental study, does an increase in engagement impact minority and Caucasians' math scores in the same manner? The analyses of the WJIII

Applied Math Scores suggested minorities and Caucasians are impacted by increased engagement in the same manner. This finding lends support to the second hypothesis.

Strength and Limitations

A strength of this study is the broadness of applied math. Applied problems cover multiple skill sets; for example, applied problems with division, fraction, multiplication, addition, or subtraction. Focusing on only one of these skills would have allowed for a greater number of learning trials and in turn a greater number of active student responses, therefore, the intervention may have produced stronger results if this skill was more narrowly focused. However, the benefit of targeting all types of applied problems at once demonstrated the generalizability of the intervention to various skills sets.

A limitation of this study was the sample size. The comparison of individual ethnic groups was not possible since minorities were grouped together due to the small number of African American, Hispanic, and Native American participants. A larger sample would have allowed comparison of each ethnic group and would have also increased the power of the study.

The group dynamics, specifically the number of students in each treatment session and the dissimilar math levels of the students, posed some challenges. As previously mentioned, three treatment sessions were conducted each day since there were three math blocks. The number of students in each session included seven students in the first and third sessions and nine students in the second session. Even though the larger session had only two additional students, the students in the smaller group seemed to require less

redirections to remain on task. Also, composing the groups with students of similar weaknesses in math application would have alleviated the need for math questions on three grade levels and would have provided for a more intense intervention at the students' functioning level. Thus, a small group setting with approximately five to seven students functioning on similar achievement levels would likely have produced the strongest results.

Implications

Theoretical implications.

The result of this study provides support for behavioral engagement and validates learning trials, with active student responses at the core, as an efficacious teaching model. Heward (1994) describes the learning trial as the contact between the learner and the teacher. This contact which includes presenting the antecedent, allowing for student response, and immediate feedback produced significant growth in a relatively short period of time for the participants in this study. This learning trial model has received criticism, for the reason, that the student responses are simple factual answers (Heward, 1994). This study, however, utilized math problems ranging from basic application to higher-level application questions. Thus, the study demonstrates student responses in learning trials are not limited to factual, single answer questions.

Practical implications.

This study suggests either minority students are receiving less academic engagement than Caucasian and Asian children or since many minority students enter the school system at a disadvantage, they may require more engagement than is typical in an

average classroom. Since the main feature of The Achievement Gap is the lag in achievement by minority children in comparison to their counterparts; in order to close this gap, minority students must show a greater amount of progress than Caucasian and Asian-American children. Therefore, providing intense levels of academic engagement for minority children is critical to closing the gap.

The significant main effect of group in the first analysis revealed 12% of the between subject plus error variance was accounted for by the group placement of increased engagement or no increase of engagement. This amount of growth over such a short period of time implies implementing this method over a longer time span would significantly impact the achievement of minority children.

Conclusions

The hope is that this study will serve as an impetus for a different type of research concerning the achievement gap. The focus of research in this area desperately needs to change in order to provide strong empirical evidence of what works with all children regardless of ethnicity or economic status. This study suggests that increasing engagement in academic tasks by means of questioning, feedback, and opportunities to respond, is one such solution.

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VITA

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Reportedly, minority children consistently lag behind their Asian-American and Caucasian counterparts in all academic areas. Extensive studies have explored the root of this problem and three main models have emerged from research in this area: Genetic Model, Socioeconomic Model, and the Sociopathological Model. However, many of the studies associated with these models are correlational in nature and many of the theories have not been tested with controlled experimental designs. Thus, this study aims to correct this limitation in the literature by utilizing an experimental design to evaluate the impact of increasing academic engagement on math achievement scores. Forty-four participants ages 10-12 participated in this study. Participants included 23% African Americans, 45% Caucasians, 5% Hispanics, and 27% Native Americans. Data were analyzed with 2 two-factor between subjects analysis of variance (ANOVA) for independent groups. Result of the ANOVA indicate a significant main effect for group condition, $F(1, 40) = 5.59, p = .02, \text{partial } \eta^2 = .12$. This result demonstrates increased engagement significantly impacts math achievement scores for minorities and Caucasians alike. The result provides support for behavioral engagement and learning trials as effective in increasing student achievement.

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