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Motivations for Learning: Mastery Experiences in a Low Socio-economic Middle School
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Abstract

The purpose of this multi-case study was to discover the causes of low self-efficacy for math for a group of historically low-performing 7th grade students at a high-poverty urban middle school based upon Bandura's (1986) Social Cognitive Theory, specifically the concept of self-efficacy. Qualitative methods were used to collect data, including structured one-on-one interviews and classroom observations. In addition, a student survey provided data on student self-efficacy and offered further insight into individual student perceptions. The cross-case analysis surfaced evidence for each of the four sources of self-efficacy. The findings of this study can provide educators with insights into the causes of low self-efficacy for students at the middle grade level and allow researchers to theorize about a broader set of cases related to learning math.

Keywords: middle school mathematics, self-efficacy, urban middle school, high-poverty

Introduction

The topic of mathematics achievement in the United States is a sum of many parts. Of special concern within this issue is that of minority students from high-poverty urban schools. A crucial juncture in the K-12 experience rests in the middle school years where the success or failure in mathematics courses often proves a substantial gatekeeper to higher-level mathematics content and the prospect of achieving a high school diploma (Balfanz & Byrnes, 2006). For some students at the middle school level, previous deficiencies in arithmetic skills accrued over the years of elementary school exacerbate the complexity of introducing algebra at this stage.

A focus on national math achievement recurs in both research studies and policy recommendations (National Mathematics Advisory Panel, 2008; Provasnik, Gonzales, & Miller, 2009). Results from NAEP in recent years demonstrate some growth in math achievement in both 4th and 8th grade, yet only 40% of 4th grade students and 35% of 8th grade students scored proficient or above in math in 2011 (NCES, 2011a). For urban districts, results on NAEP reveal even lower levels of achievement in math (NCES, 2011b) while other measures of math achievement in urban schools show consistently alarming results (Rowan, Hall, & Haycock, 2010; Ysseldyke, Spicuzza, Kosciolek, Teelucksingh, Boyes & Lemkuil, 2003).

The preponderance of minority students who have achievement gaps upon entering high-poverty middle schools typically see their achievement gap widen by the end of their middle school experience (Balfanz & Byrnes, 2006). It is during these critical middle school years that students will formulate judgments about their own interest in math and their ability to learn math, and once entrenched, these judgments will shape the life-long opportunities available to these students (NCTM, 2000). A student's lack of confidence in their ability to succeed in math can contribute to a discouraging attitude toward math in the middle grades when the study of math transitions from a focus on concrete sequential procedures to abstract algebraic reasoning (McNeil, Grandau, Knuth, Alibali, Stephens, Hattikudur, & Krill, 2006). A history of low performance can promote low self-efficacy for math. Identifying the causes of low self-efficacy for math may provide educators with strategic means of supporting students at the middle-grade level.

Self-efficacy, according to Bandura, "refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments (1997, p. 3). Bandura theorized that what is foundational in forming one's level of motivation, as well as their emotional status and what they act upon is based more on their beliefs about themselves rather than what is objectively true. "Unless people believe they can produce desired efforts by their actions, they have little incentive to act. Efficacy belief, therefore, is a major basis of action. People guide their lives by their beliefs of personal efficacy" (Bandura, 1997, p. 3). These beliefs play a powerful decision-making role in the lives of students. A latent hazard of low self-efficacy beliefs for mathematics formed early during the middle school years may cause students to avoid taking challenging academic courses in the future if they doubt their abilities. The more immediate hazards of low self-efficacy for math can be seen in how these beliefs impede their day-to-day interaction with the math instruction and curriculum.

With increased attention on math achievement and the stubborn resistance to improvement represented in substantial numbers of students, knowing what is happening with students who lack the inner belief that they can succeed in math could produce helpful insight. Employing the lens of Bandura's (1986) Social Cognitive Theory as a theoretical framework can discern the sources of low self-efficacy for students. By recognizing the four sources of self-

efficacy 1) mastery experience, 2) vicarious experience, 3) social persuasion, and 4) physiological states, exploring the causes of low self-efficacy can identify means of responding to these students that influences increases in self-efficacy for learning math.

A history of low performance contributes to low self-efficacy and educators who serve these students encounter the conundrum of responding to students' academic deficiencies while attempting to meet grade level standards. The contributing factor of poverty and the urban context of the school provide a distinguishing perspective for this study. Resilience in challenge, an outcome desired in math instruction and a vulnerable attribute for children living in poverty (Downey, 2008; Spencer, Cole, DuPree, Glymph, & Pierre, 1993) illuminates aspects of this study. Identifying the causes of low self-efficacy for math may provide educators with strategic means of supporting students at the middle-grade level.

The purpose of this multi-case study was to discover the causes of low self-efficacy for math for a group of historically low-performing 7th grade students at a high-poverty urban middle school. At this school, 85% of the students lived in poverty. By selecting four students for cross-case analysis, this study sought to gain a richer understanding of how students judge their ability to engage in learning math within a context of poverty. From this analysis we can hold a better position for offering remedy to students at this level who struggle to learn math. The following research question guided the study:

> What are the causes of low self-efficacy in math mastery experiences for historically low-performing students at a high-poverty urban middle school?

Review of Literature

This review of literature builds upon the complementary notions of self-efficacy by exploring the understanding of the concept of self-efficacy, then a presenting a discussion of self-efficacy beliefs among cross-cultural contexts. A concise examination of motivation for learning provides a broader consideration for our study. The context of middle school and the influence of poverty further inform the review of literature as these factors frame the context and design of our study.

Self-efficacy

A key component of the social cognitive theory is the concept of self-efficacy (Zimmerman, 2000). Self-efficacy has received considerable attention from educational researchers as relating to how students approach learning and the construct of classroom experiences. Others have drawn distinction to how students encounter learning mathematics (Usher & Pajares, 2009; Williams & Williams, 2010). Usher and Pajares' (2008) review of literature on self-efficacy in schools confirmed self-efficacy beliefs as, "the critical determinants of human motivation and behavior" (p. 791). When considering learning experiences for students, recognizing these elements of motivation and behavior provides an elaborate backdrop for discerning the influences upon the teaching and learning processes.

Bandura identified four types of behaviors or processes regulated by self-efficacy beliefs. The processes, which include cognitive, motivational, emotional, and choice, are critical to achievement in academic settings, namely a school classroom (Pajares, 1996). Variability of self-efficacy exists among students establishing criteria of high and low self-efficacy. Students with high self-efficacy are more likely to: engage in higher order thinking; show greater effort and persistence; demonstrate an affect of curiosity and eagerness; and broaden their consideration of

what goals to set for themselves and what activities to participate in (Snowman, McCown & Biehler, 2012). Contrastingly, students with low self-efficacy are likely to disengage from learning experiences or avoid the academic demands in an attempt to relieve themselves from the recurrence of failure or emotional distress (Zimmerman, 2000).

Self-efficacy Beliefs

Beliefs about one's abilities reveal differentials that can introduce inaccuracies between beliefs and actual abilities. Williams and Williams (2010) used the 2003 PISA to explore the cross-cultural effect of self-efficacy and math performance. Their findings affirmed that self-efficacy is a concept that applies to students in many cultures. Their model was a "good fit to the data in 30 nations and was supportive of reciprocal determinism in 24 of these, suggesting a fundamental psychological process that transcends national and cultural boundaries (p. 453)." Interestingly, their study also identified that the influence of external agency (the expectation of significant others) influences the self-efficacy of girls across cultures. Girls everywhere, it seems, underrate their capabilities in mathematics relative to boys with the same degree of mastery. In a similar way, girls evidence lower levels of self efficacy with respect to mathematics, along with higher levels of anxiety, helplessness, and stress" (Williams & Williams, 2010, p. 463-464).

The accuracy of student self-efficacy can contribute to their beliefs about their prospective outcomes. This applies to performance in math as noted in studies by Chen (2003) and Chen and Zimmerman (2007). Such impact on math can influence middle school students' perspective on their performance and their effort judgment with implications for both students and teachers. From Chen's study, the direct effect of self-efficacy on math performance influenced the amount of efforts students invested in learning math. Recommendation from this study for math teachers suggested:

> Teachers should recognize that calibration accuracy is an important dimension of their students' math self-efficacy beliefs. As a group, seventh-grade students overestimated their math capabilities, but their inaccuracies did not relate to the strength of their self-efficacy beliefs. Both high and low self-efficacy students were overly optimistic about their performance. Although such over-optimism may enhance their motivation to improve future performance, students' underlying math skill also significantly factored into their academic success (Chen, 2003, p. 90).

Chen and Zimmerman (2007) found this incongruity between self-efficacy beliefs and performance in math when considering students from cross-cultural contexts. When comparing middle school students from Taiwan and the United States, they found that students from Taiwan demonstrated a higher degree of accuracy than the American students. This inaccuracy presents a challenge for teachers to contemplate and to determine the need for alignment between beliefs and performance. Bringing students' self-efficacy into congruity with performance is suggested by other researchers (Campillo, Zimmerman, & Hudesman, 1999; Zimmerman, Bonner, & Kovach, 1996). Thus consideration of the accuracy of students' self-efficacy needs to interface with the measured levels of particular students, such as psychometric test scores. When supporting students who have a history of low-performance in math, as our study endorses, addressing the discrepancy of self-efficacy and performance introduces another contingency for re-engaging students in learning math.

Motivation for Learning

When supporting students who have a history of low-performance in math, the matter of motivation for learning surfaces as a critical factor in overcoming the barriers to academic success in math. Zimmerman (2000) suggests that self-efficacy serves as indicator of motivation. "Self-efficacy beliefs have also shown convergent validity in influencing such key indices of academic motivation as choice of activities, level of effort, persistence, and emotional reactions" (p. 84). For students such as those in this study, effort, persistence and emotional reactions can contribute to revealing respective levels of self-efficacy. Zimmerman highlighted to notions of effort—rate of performance and expenditure of energy (2000). Although these illustrate indicators of self-efficacy, it is important to remember that these are merely predictors of motivation.

Considering the placement of motivation for learning as intrinsic through curiosity or interest, middle school students at-risk of school failure represent an intersection of influences in schools (Anderman & Maehr, 1994; Dweck & Leggett, 1988). At-risk indicators, such as delayed academic skill development, poverty, concentration of poverty within an assigned school, and race highlight gaps in the development of intrinsic motivation associated with school-structured activity. Niehaus, Rudasill, and Adelson (2012) drew connection between self-efficacy and academic outcomes for Latino middle school students concluding consistent findings with prior studies "suggesting that academic self-efficacy is an important contributor to positive academic outcomes for Latino students" (p. 129). These researchers found that students possessing intrinsic motivation for learning directly correlated to their academic achievement as measured by grade point average. Recognition of the role of motivation for student learning can expose a related factor to self-efficacy, assuredly beyond the scope of this study yet in accordance with this line of inquiry.

Method

This study utilized a multi-case study design to discover the causes of low self-efficacy for math. Yin (2005) endorses the use of case study to descriptions that enhance awareness and analytical insight that promotes knowledge. Each selected student represents a separate bounded case. By bounding the cases to individual students, gaining understanding of their distinct conditions will provide opportunity for analysis (Stake, 2000). Qualitative methods were used to collect data, including structured one-on-one interviews and classroom observations. In addition, a student survey provided data on student self-efficacy and offered further insight into individual student perceptions.

This study utilized a cross-case analysis of four students who demonstrated varying degrees of self-efficacy. The four students selected for case study were participants in a larger year-long study involving 24 students conducted at an urban middle school in a Western state. The research design represented a convergence of practitioner research and empirical study in which participants enrolled in a math class for 90 minutes each day. Three researchers contributed in distinct ways: one researcher served as the classroom teacher and collected assessment data, a second researcher served as the Principle Investigator and provided daily instructional support within the classroom and documented observational data, and the third researcher administered the surveys and conducted the one-on-one structured interviews with students.

Data Sources

The students participating in this study attended a historically underperforming middle school (grades 6-8) where over 85% of the students lived in poverty. All participating students had demonstrated a history of low-performance in math and over 50% were English Learners. Therefore, the context of this study provides a valuable perspective for exploring the roots of low self-efficacy for math.

Sample selection. The larger, year-long study included 24 students purposefully selected to match the demographics of the school. The selected students represented 80% Latino, 10% African-American, and 10% Caucasian with equal number of male and female students. Although all 24 students were historically low-performing in math, the four students selected for analysis in this study represent a contrast within the larger group. Two of the students (one male and one female) demonstrated higher levels of achievement while the other two students (one male and one female) demonstrated lower levels of achievement. The four students revealed varying degrees of self-efficacy for math and responsiveness to efforts to change.

Data collected. Data was collected from four sources involving all three researchers. One researcher conducted one-on-one interviews with participating students and administered a survey to help determine their level of self-efficacy for math. The structured interviews utilized a protocol to ensure consistency in data collection among participants. The survey instrument was developed based upon a study conducted by Usher (2009) to determine sources of self-efficacy for math among middle school students. The instrument asked questions to mine responses revealing the four sources of self-efficacy discussed in the theoretical framework.

The interviews and survey administration were conducted early in the school year. Assessment data were collected by the researcher serving as the classroom teacher. Such data included in-class and homework assignments, formative and summative assessments, and district-sanctioned benchmark exams. The researcher providing instructional support gathered daily classroom observations, including individual and small-group interactions.

Data Analysis

A narrative was constructed for each case to incorporate the data collected into a story to depict illustration of the cogent concepts aligned with the theoretical framework guiding the study. Establishing validity within each case marked the first step in building trustworthiness in the study. The multiple data sources provided for triangulation within each case, which involved a "process of using multiple perceptions to clarify meaning, verifying the repeatability of an observation or interpretation" (Stake, 2000, p. 443).

Participants

The cases of the four selected students are portrayed in concise format. More extensive cases of each student were constructed for analysis purposes. These cases emerged from a compilation of classroom observations, review of assessment data, interviews, and student responses to the survey instrument. The presentation of the four cases—Maria, Manuel, Missy, and Bobby—provides descriptive data for analysis. Pseudonyms have been used to mask the identity of the students. The first two students portrayed, Maria and Manuel, demonstrated higher levels of achievement and revealed fluctuating levels of self-efficacy (i.e., selectively low one time and malleable the next time). Missy and Bobby demonstrated lower levels of achievement

and persistently low levels of self-efficacy. Each case provides evidence of the causes of self-efficacy analyzed through the theoretical framework of this study.

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Findings

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Bandura's (1986) Social Cognitive Theory and component self-efficacy provided a lens for determining the causes of low self-efficacy for the students in this study. The cross-case analysis conducted after composing the four individual cases surfaced evidence for each of the four sources of self-efficacy that yielded a set of findings that may provide a way of theorizing about a larger collection of cases, or particularly other students similarly situated (Stake, 2008).

Mastery

Lack of, or inconsistent mastery experiences contributed to varying levels of self-efficacy for math among these students. Usher and Pajares (2006) concurred with Bandura (1986) that students' perceived mastery experience serves as a contributing predictor of self-efficacy. As mastery learning is such a critical source of self-efficacy, when students fail to experience mastery learning the recurrence of failure compounds their agency for self-efficacy. Since the nature of learning mathematics relies so heavily upon prior knowledge, the developmental design of math instruction exposes the gaps in students' previous learning experiences. In each of the four students, previous assessment results (low or inconsistent levels of achievement) indicated that many math concepts had not been mastered in preparation for 7th grade.

Bandura (1986) asserted that mastery experience was the most influential source of efficacy as individuals can relate to their authentic experiences, rather than contrived or externally imposed (and possibly inauthentic) information. Accordingly, successful experiences raise efficacy while failures lower efficacy. Analysis of the four students revealed an exception in Maria from the other three students. For Maria, she drew upon her successes and reflected upon her failures to promote new mastery experiences. This additive notion of mastery experiences enhanced her overall self-efficacy. For Manuel, the inconsistency of his experiences did not seem to deter his approach to learning math, yet the mix of success with failure inhibited his growth in self-efficacy, perhaps repressing to some extent his potential for learning. Missy's inaccuracy of abilities influenced her perception of mastery experiences perhaps obscuring her own awareness and masking her view of self. Meanwhile Bobby's trend of decreasing achievement since 5th grade revealed that fewer mastery experiences may have contributed to his low self-efficacy and perhaps to his resistance to efforts to enhance his self-efficacy for math.

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Discussion

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The challenges of math achievement facing schools are not new nor are decrees for reform to math instruction. Research and policy proposals have outlined the need for increased emphasis on math and have provided startling data analyses while prescribing the steps to improve outcomes for students. Yet the deficiencies in math achievement persist. As set forth at the outset of this paper, the critical juncture of the middle grades exposes a host of issues affiliated with learning math. For consideration in this study, the self-efficacy for math of historically low-achieving students in an urban middle school provides a context for exploring the influences that impede deep engagement in math.

Balfanz and Byrnes (2006) showed the widening of achievement gaps for minority students enrolled in high-poverty middle schools. It is our assertion that the self-efficacy for math of students contributes to their willingness and readiness to engage in the abstract, logical mathematics, which comprises much of the standards-based curriculum of middle schools. Discerning the causes of low self-efficacy for students can inform decision-making related to instruction, course offering, and strategies to re-engage students during this critical stage in the educational experience.

Approaches to Instruction

Teachers can influence the self-efficacy of students by addressing the four multiple sources of these beliefs. Beyond a repertoire of instructional strategies based upon pedagogically sound teaching techniques, teachers that serve students with low self-efficacy for math will also need to utilize strategic motivation, to form a nurturing classroom environment, and to employ feedback mechanisms that reflect an awareness of students' low self-efficacy.

Effort is an important component in the process of learning math. As teachers observe students with low self-efficacy, they may likely conclude that these students merely refuse to put forth effort. Zimmerman (2000) asserts that self-efficacy beliefs predict student effort by illustrating the rate of performance and the expenditure of energy. Such beliefs also influence persistence, a related manifestation of self-efficacy. Therefore, understanding the causes of low self-efficacy can inform teachers' perspective on student effort. Additionally, understanding the indicators of low self-efficacy could aid instructors in the classroom. As with the students in this study, effort was usually reflective of their beliefs in their ability to succeed. Teachers who can discern these beliefs can reconsider their conclusions about similar students and address the sources of self-efficacy through their instructional practices.

Re-engagement

Students with low self-efficacy for math require intense and recurring re-engagement strategies to counter their own beliefs about math. One such strategy involves the use of feedback. The binary nature ("correct" or "incorrect") of a traditional approach to solving math problems leans toward poignant responses to student-generated answers. Students with low self-efficacy have experienced recurrence of failure due to a lack of, or inconsistent frequency of, mastery experiences. The form and approach to feedback in these mastery experiences plays an important role in re-engaging students. For students living in poverty, failure and the obstacles to success present frequent reminders that teachers must help them overcome.

When a teacher possesses an awareness of students' low self-efficacy, they can construct feedback mechanisms that encourage students toward accurate mathematical thinking. William (2011) distinguishes between *ego involving* feedback and *task involving* feedback with clear implications for students with low self-efficacy. Ego involving feedback, such as grades or praise, is rarely effective and can actually lower student achievement. Rather, task involving feedback identifies for students what they need to do to improve and provides clear explanation of how to go about the process of improvement. For students with low self-efficacy for math, the recurrence of low grades or the absence of praise from their teacher further erodes their willingness to engage in the learning process, thus the need for feedback that promotes learning by helping students move forward in their learning (Heritage, 2010).

Usher (2009) asserts that students' personal beliefs in their skills and abilities can impact their level of engagement in learning math, therefore the type of feedback a teacher provides can

either considerably enhance or further entrench those beliefs. With an awareness of the levels of self-efficacy among their students, a purposeful approach to feedback will provide an opportunity to support students toward overcoming the obstacles to learning math.

Conclusion

If we can recognize the causes of low self-efficacy for math, then changes can occur to combat the debilitating results of these beliefs among students. The four sources of self-efficacy identified by Bandura (1986) provide a framework for discerning the behaviors, responses, and feelings of students as they encounter math. The four students portrayed in this multi-case study provide a glimpse at the causes of low self-efficacy. According to Bandura and others, levels of self-efficacy can be influenced through personal context and derived outcomes, thus an awareness of these causes can inform educators regarding approaches to utilize to serve students.

For students at the turbulent stage of middle school, this intersection of past and future illuminates a critical juncture as their past years of schooling and experiences have shaped their beliefs about their own abilities and can impact their judgments about the future. This study considered the causes of low self-efficacy for students in a high-poverty school. The tenuous conditions of poverty may intensify the influence of the sources of self-efficacy. Therefore strategic responses from educators to engender resilience in students provide an approach to addressing low self-efficacy for math. Altering the trajectory of students such as those in this study will require purposeful attention to the sources and how they influence students in the precarious middle school years.

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