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Introduction

Some students do not like math. Some students prefer to play sports rather than read a book. Some students enjoy the exhilaration of video games more than the Eureka! moments in a science experiment. Oh, but some students really don't like math. Why is it that as students matriculate through the K-12 experience, a crescendo of students demonstrates (through their behavior and test scores) their disdain for the study of mathematics? The intensification of such attitude toward math emerges in the middle grades when the study of math transitions from a focus on concrete sequential procedures to abstract algebraic reasoning (McNeil et al., 2006).

At this critical stage in the educational timeline, previous deficiencies in arithmetic skills exacerbate the complexity of introducing algebra at the middle grade level. While these challenges create problems for teachers who seek to teach students a subject matter that generates angst in some young people, they also compound the obstacles for those students who face a daunting reality of increasing difficulty or recurring failure. The response of students in this predicament can offer a glimpse into their

perspective. Do they believe that they can even "do the math" in front of them?

Mathematics presents tremendous opportunity to discover order within Creation and to consider the means by which God holds all things together. Philosophers such as Augustine (1993) and Aquinas (Thomas & Gilby, 1969) promoted the virtue of studying mathematics as exercise in logic and reason, through which one can discern attributes of God. From skills in logic one can comprehend the plan of salvation as articulated through the Pauline epistles. However, students who disengage from the study of math will miss this means of recognizing God's revelation which can provide all the more motivation for Christian educators to acknowledge the consequences for students with low self-efficacy for math.

Context of the Study

Student achievement in math has revealed deficiencies in student learning which is exacerbated for urban districts with high portions of students living in poverty (National Center for Educational Statistics, 2011; Ysseldyke, et al., 2003). Identifying the causes of low self-efficacy for math may provide educators with a fuller understanding of some of the reasons for such disturbing assessment results. Self-efficacy served as a centerpiece of Bandura's (1986) Social Cognitive Theory and indicated beliefs about performance capabilities in regards to particular tasks or skills. Such beliefs may differ depending upon the domain of functioning such as completing math problems as opposed to writing poetry or playing sports (Zimmerman, 2000). Therefore, the distinction of self-efficacy for math will remain the focus as it pertains to the beliefs of the students in this study.

The four sources of self-efficacy—mastery experience, vicarious experience, social persuasion,

and physiological states—are central to Bandura’s (1986) Social Cognitive Theory which will be used as a theoretical framework for this study to discern the causes of low self-efficacy for math among students. Employing this theoretical framework to this study may imply a tacit endorsement of Bandura’s view of human existence, but such is not the case. This theory overlooks the sinful nature of man and to that, Christian educators and researchers alike must acknowledge a gap that we concede. However, this theory of human functioning exposes the frailty of the human condition through which we can explore the obstacles to learning and human flourishing.

This multi-case study of historically low-performing 7th grade students in a math class at an urban middle school is framed at a critical intersection in the educational pipeline as it is situated at the middle school level (7th grade) and with at-risk students. The middle school context exposes the transformation for students while the students participating in the study represent a population in great need of service. The developmental changes that students at this age experience contribute to the transformation as the physical and cognitive changes impact dramatically their social relationships and personal perception (Eccles, 1999). At this convergence, the opportunity exists for Christian teachers to expose the order of God’s revelation in Creation through teaching mathematics—these windows must remain open for students who become inclined to disengage as a result of their low self-efficacy.

The students participating in this study could be classified as at-risk for a number of factors. They attended a historically underperforming school where over 85% of the students are classified as economically disadvantaged. All had demonstrated a history of low-performance in math and over 50% were English Learners. These students are discouraged. At the tender age of adolescence, they experience doubts about themselves and their future. Living in tenuous urban conditions of poverty and disenfranchisement contributes to their personal perception. Therefore, the context of this study provides a valuable perspective for exploring the roots of low self-efficacy for math. For teachers serving students such as these, insight into the causes of low self-efficacy can reveal recommendations for instructional practices.

Through understanding the perception of students and interpreting their behavior toward math, teachers can utilize strategies that prove supportive of student learning and seek to change the outlook of students so as to keep them open to explore Creation.

Yet to serve these students, Christian teachers need to know what these students are experiencing. Love and encouragement can combat a number of the factors at play, but a grounded knowledge of the causes of low self-efficacy can offer ways to change the trajectory of such self-perceptions. Christian teacher educators can also benefit from understanding the context into which aspiring teachers will serve so as to aptly prepare teachers for effective practice. Teaching students with low self-efficacy for math involves a blend of pedagogical content knowledge, motivational expertise, and strategic use of feedback to students that promotes learning. Knowing what is happening with students who lack the inner belief that they can succeed in math could produce helpful insight for instruction that supports learning and provides a conduit to God’s revelation.

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 conducted at an urban middle school in a Western state. The research design represented a convergence of practitioner research and empirical study. Three researchers contributed in distinct ways: one researcher served as the classroom teacher and collected assessment data, a second researcher served as the principal 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. Findings from the analysis of the cases depicted in this article will allow for a richer understanding of the causes of low self-efficacy that can inform practice of Christian teachers who encounter students similarly situated and desire to engage them in learning the skills of deduction and logic that open windows to understand God’s revelation. Also, this study will provide perspective for teacher educators who seek to prepare effective classroom teachers to serve the children in our public schools.

Theoretical Framework

Bandura's (1986) Social Cognitive Theory served as the theoretical framework for this study. In explaining the inner workings of human behavior, the theory considers the interrelationship of an individual's personal characteristics along with the behavior and the environment of the individual. The particular component of this theory for purpose of this study is the concept of self-efficacy. Since this study focused upon the self-efficacy of students the theoretical framework distinguishes the application of this concept exclusively to students in an educational context.

Bandura (1986) defined self-efficacy as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (p. 391). Individuals construct self-efficacy beliefs from four informational sources. The first, mastery experience, is the most powerful of the four sources and is based on a person's previous successes or failures in a given area. Successful experiences strengthen one's self-efficacy and fosters an increase in levels of confidence, willingness, and resilience in attempting related tasks. Perceived failures in a given area can weaken one's self-efficacy and serve to demoralize and discourage future attempts of related tasks. Accordingly, continued avoidance of taking on related tasks only compounds the likelihood that these students will not experience success in their academic efforts. These mastery experiences have an enduring effect on self-efficacy beliefs.

A second source informing self-efficacy beliefs is through vicarious experiences. By observing the experiences of another person who is viewed as sharing similar characteristics and capabilities, the outcome of the observed experience may become attributed to the observer's own self-efficacy beliefs. For students, these vicarious experiences often occur between friends or among classmates in an educational setting. The role of models endorses vicarious experiences as students make comparisons to other students or adults in ways that impact the judgments they form about their own perceived abilities. Eccles (1999) wrote of the developmental changes that occur during adolescence, promoting a heightened awareness of socialization experienced by students at the middle school level, which may

also contribute to the importance of vicarious experiences for students.

Social persuasion is the third informational source of self-efficacy beliefs. Encouragement and support offered by peers, teachers, mentors, and parents and other relatives can play a part in raising confidence in one's ability. Persuasive efforts must overcome the authentic experiences of the individual to be fruitful as persuasion can only "contribute to successful performance if the heightened appraisal is within realistic bounds" (Bandura, 1986, p. 400). Therefore, persuasion offers a limited impact. However, since adolescents generally lack the refined skill to make accurate self-appraisals, the propensity for them to form judgments based upon evaluative feedback from others remains strong.

The fourth source people use to inform their capabilities is their emotional and physiological states. Feelings of stress, anxiety, and a having sense of dread tend to communicate deficits in one's capabilities to perform a task. Such feelings can impact the judgments students make about their own strengths and vulnerabilities. In this study, those emotional and physiological states that arose from learning math provided evidence of this source of self-efficacy. As the students in this study are historically low-performing in math, we anticipated evidence of strong emotional reactions to elements related to math such as presence in a math classroom, exposure to math instruction, and receipt of corrective feedback.

Relying upon Bandura's (1986) theory of the sources of self-efficacy as the framework for this study provided a lens for discerning the causes of low self-efficacy for math. This perspective guided the data collection and analysis. By analyzing the sources of self-efficacy, this study will help reveal the causes of low self-efficacy for math among a group of students. The research question guiding this study was:

What are the causes of low self-efficacy for math for historically low-performing students in an urban middle school?

Method

This study utilized a multi-case study design to discover the causes of low self-efficacy for math. Yin (2005) endorsed 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, 2008). Qualitative methods were used to collect data, including structured one-on-one interviews, classroom observations, and information gathered from parent conferences.

–Data Sources

Sample selection. Initially 36 students entering 7th grade students were recommended for participation in the study by their 6th grade teachers. However, 24 students were purposefully selected to match the demographics of the school. The selected students represented 80% Latino, 10% African-American, and 10% Caucasian. The number of male and female students was divided evenly at 12 each. Of these students, 55% were English Learners. Involvement included enrollment in a math class for 90 minutes each day with instruction provided by two of the researchers. One of the researchers served as the classroom teacher while the second researcher provided instructional support. Of the 24 students in the class, parents of 20 gave consent to participate in the formal study. The other four students enrolled in the class, but did not participate in the study.

The four students selected for analysis in this article demonstrated varying degrees of self-efficacy for math. Each one represents a categorization determined by the researchers during the course of the study that qualifies their self-efficacy for math and their response to efforts to change. Figure 1 depicts the four categories: selectively low, consistently low, malleable, and resistant.

Selectively Low Adam	Consistently Low Jillian
Self-Efficacy	
Malleable Abbey	Resistant Bobby

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 was 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

The construction of a narrative of each case offers a concise means of incorporating the data collected into a story. Pseudonyms are used for each student to protect their identities. Although extensive data was collected and coded for each student, limitations of space preclude an extensive portrayal of each case. Therefore, the cases depict only illustration of the cogent concepts aligned with the theoretical framework guiding the study.

A cross-case analysis was utilized to determine the causes of low self-efficacy for math among these students in accordance with the sources of self-efficacy (Bandura, 1986) as articulated in the theoretical framework. The consolidation of similarities and differences provided a format for analysis. Figure 2 illustrates the cross-case analysis. The cases in this study were “chosen because it is believed that understanding them will lead to more comprehensive knowledge and, perhaps, better theorizing about a still larger collection of cases” (Stake, 2008, p. 122). The analysis sought to discover findings that can inform teacher practice regarding students similarly situated.

	Mastery	vicarious	social persuasion	physiological states
Adam	Perception of mastery does not necessarily align with evidence	Brother presents a model	Very sensitive to encouragement from teachers and discouragement from peers	Enjoys doing math
Jillian	Recurring failure with momentary experiences of success	Highly conscious of academic and social hierarchy in school	Inaccurate self-appraisal, seeks affirmation from others	Anxiety while in math class → avoidance
Abbey	Inconsistent mastery experiences	Comparisons to friends (both extremes)	Strong reliance upon feedback (positive and negative)	Responsive attitude & feelings to success
Bobby	Decrease in achievement	Brother presents a model	Intense reaction to feedback	Physical reaction to expectations related to math

Cases

The cases of the four selected students are portrayed in concise format for this article. 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 individual cases are presented as: Adam, Jillian, Abbey, and Bobby.

–Adam

Adam is an English Learner and, during 7th grade, was emotionally immature. He expressed repeatedly that he really liked math. In fact, at the outset of 7th grade, he believed that it was his best subject in school. According to him, “You use math in almost every subject, so it’s really important.” Although he enjoyed math, it was not his favorite subject—that label belonged to both language arts and science. He determined, “In science, we do experiments so that is cool. In language arts we learn new words and that is really important.”

Adam recognized that math could present some challenges. During the first week of 7th grade, he presented to the teacher with much gusto his solution to a math problem that involved the use of long division. His self-generated algorithm was so incompatible with the rules of math that the teacher chose not to correct his error, but rather explained

gently, “We’ll need to revisit this one. Watch carefully how I do it.”

His recognition of challenges with math arose most dramatically in 6th grade. Adam earned high marks for math in 5th grade and, according to him, “I felt like I was nerdy and smart.” However, his results on the state math assessments indicated the lowest level of achievement according to the state scale, “far below basic.” Adam acknowledged that in 6th grade, “I didn’t get it a whole lot.” In fact, he earned a “D” for math in 6th grade while demonstrating an achievement level on the state assessment of one band improved from 5th grade to “below basic.”

This emerging distinction between his feelings about math and his performance was demonstrated in his responses to the self-efficacy survey. He indicated that it was “mostly true” that there were students in his math class who can work problems faster than he could and that it was only “a little bit false” that learning how to be a better math student was easy for him. He also indicated that it was “a little bit true” that he felt nervous about doing math and that he needed a lot of help to succeed in math. Most telling was his indication that it was “mostly true” that even when he studies very hard, he does poorly in math.

Adam has a younger brother in 4th grade (at the time of the study) who also claims to enjoy math and earns high marks in his 4th grade math class.

During a home visit by the researcher, Adam and his brother contested over math-related topics. Aware of his brother's prowess in math, Adam persistently asserted that his math skills were better than his brother's ability. The angst in Adam in regards to his brother was evident in this interaction.

Adam would often respond physically to both his successes and failures when learning math. His celebrations of success would involve raising his hands above his head and offering a wide-toothed grin. When informed of his inaccuracies in calculations or problem-solving, his response involved assuming a posture of turning face-down toward the desk and hunching forward his shoulders as if to guard himself until he emerged from his self-contrived "cave" with the correct answer.

In addition to the awareness of his brother, Adam also expressed a heightened sensitivity to the acknowledgement of others. Observations within the classroom revealed contrasting responses to the actions of others demonstrating fluidity in his level of self-efficacy. When praised by his teacher, he sat up straight in his chair and conscientiously progressed with practicing his math. When working in small groups or with a partner, when other students interacted negatively with him, he took offense and refused to participate with them in classroom activities. Such reaction to the approval and disapproval of others contributed to his willingness to engage in learning math.

During the course of the 7th grade year, Adam made marked improvement in his math achievement. His willingness to answer teacher-initiated questions and ability to remain engaged in small-group instruction demonstrated his interest in math. Adam claimed, "Doing math is fun. Even when I don't get the right answer, I like trying to do it." On many occasions, his answers to teacher-initiated questions or his solutions to math problems during small-group instruction did, in fact, reveal incorrect answers and errant mathematical logic to which he would receive correction and attempt to solve the problem correctly.

—Jillian

For Jillian, school presented a host of challenges, many of which she saw as insurmountable. She is an English Learner and, during 7th grade, was very socially insecure. Math was her weakest subject and

her least favorite. According to her, "In math, I don't catch on. I don't get it and I don't like the pressure people put on me." Indeed, when pressed by her teacher to focus each day and to make a consistent effort, her response was often intensely negative or contained a host of avoidance strategies. In her words, "People make me feel like I'm stupid." Her behavior toward math consistently revealed this type of attitude throughout the 7th grade year.

In 6th grade, Jillian received an "F" in math class and scored "far below basic" on the state math assessment. Through reflection she explained why she had a low self-perception of her ability, "I try, but sometimes I don't get it." She experienced some success in 5th grade when her uncle helped her understand math, which made her feel like she was smart. According to her, "In 7th grade, now there are more letters and numbers and I have to try harder."

From the interview conducted early in the 7th grade year, Jillian expressed her intent to try harder than she had in past years of school. Her responses to the self-efficacy survey revealed a level of candid perception. She indicated that it was "a little bit true" that many students in math class can work problems faster than she could and that she feels nervous about doing math. She indicated "definitely true" for two items: that she needs a lot of help to succeed in math and that even when she studies very hard, she still does poorly in math.

She did encounter a concept in 7th grade math in which she experienced much success. She learned to complete two-step algebraic equations with a high level of proficiency. This success allowed her to serve as a tutor to other students in the class in a partner arrangement to help them learn this specific concept. These cooperative arrangements brought Jillian in direct contact with other students who lacked proficiency in this particular mathematical skill. Observations of these interactions revealed increased levels of self-efficacy through her time on-task and in her demonstrated ability to explain accurately the steps in this operation. When this concept arose intermittently throughout the year, she would respond with energy and willingness to engage in the lesson for that moment.

Her perception of need of assistance and prospective failure was perhaps more reflective than

her intent to try harder. Over the course of the year, her performance steadily deteriorated as she experienced recurring failure. Her motivation waned as she struggled to perform math operations and became overwhelmed with both the content of the course and the social interactions with other students. Her recurring attempts to seek affirmation from others in the class for off-task behavior frequently interfered with instruction and her opportunities for learning math. A vivid illustration of this was reflected in her awareness of the social and academic hierarchy as she frequently attributed to her math class as, “We’re the dumb class” or “We’re special ed.”

The anxiety that she indicated in the survey early in the school year surfaced as the school year progressed. Avoidance strategies emerged as she became less and less willing to engage in learning math. Attention seeking of other students, off-task behavior, frequent requests to exit the classroom, and demonstrations of inappropriate classroom behavior dominated her time in math class.

–Abbey

Abbey presented a cheery disposition and enthusiasm for learning that was confounded by a tendency toward discipline problems. However, she was rather self-aware for a 7th grade student. In one reflective expression early in the school year she determined, “Last year [in 6th grade] there was too much drama. This year I want no drama.” Unfortunately, she became involved in a number of infractions at school that interfered with her opportunities to learn math. Her family members condemn this pattern of behavior and pleaded with her to cease. Yet her time in 7th grade math class was marked by inconsistencies.

For Abbey, math was the subject in which she felt the weakest because, “It is hard and I don’t understand it. I really don’t like math.” She described that recurring failure, “made me feel like a failure.” Interestingly, her scores on the state math assessment reflect a variable pattern. In 4th grade, she scored “proficient” yet in 5th grade she scored “below basic.” Then in 6th grade her score rose to “basic” indicating the capacity for growth. Such trends were demonstrated throughout the 7th grade year as she demonstrated times of conscientious effort to learn math and other times of outwardly directed conflict.

On the self-efficacy survey she indicated “definitely true” for two items: that many students in math class can work problems faster than she could and that she needs a lot of help to succeed in math. She also indicated “mostly true” that she feels nervous about doing math work, that even when she studies very hard, she still does poorly in math, and that she is not a good math student. Such responses revealed a lot of anxiety and predetermined outlook on learning math.

Interestingly, one of her best friends in class experienced much success in learning math during the year. At times the influence of her friend’s success prompted her to work diligently to try to learn. Nearing the end of the year, when her friend decided that she would like to take algebra in 8th grade, Abbey asserted that she, too, wanted to take algebra and demanded that she be allowed to take the school-based algebra placement test. She was also responsive to negative influence that distracted her resulting in a pliable perspective on her ability and willingness to learn math.

Perhaps more than any student in the class, Abbey craved individual attention when attempting math problems, frequently raising her hand or asking for support. In classroom observations, she demonstrated a high level of receptivity to this assistance. When offered assistance from the teacher, she would actively engage in learning math. When removed, she often would disengage or resort to avoidance strategies.

When Abbey experienced success in math, she would praise herself, dance, or do a cheer. When she experienced failure, she became animated and confrontational. On her self-efficacy survey, she indicated “definitely false” to two items: that she feels relaxed when she does math and that thinking about math gives her a good feeling. Such strong sentiments reveal levels of anxiety in regards to learning math. Such contention was demonstrated along with times of receptivity to learning math.

–Bobby

Bobby demonstrated ability but also entrenched unwillingness to do well in math. He is an English Learner with a twin brother who was a high achieving student in another 7th grade math class. He stated early in the 7th grade year that math was his weakest subject because, “It is hard for me and has been every school year. In 7th grade, the

problems are even harder.” Although his parents have high expectations for him, his reluctance to invest effort in math was demonstrated by common refusals to try, animated reactions to directions for assignments, and persistent requests to play computer games.

In 5th grade he scored “basic” on the state math assessment and in 6th grade his score dropped to “below basic.” During 7th grade the scores on his summative assessments, including district generated benchmark tests were “below basic” contributing to his perception that math is difficult for him. Interestingly, when taking district generated benchmark tests (four times during the year), he invested more time taking the test than almost all other students in the class. He would first scan the test to see which questions he believed he could answer and then ponder the remaining questions, looking at the items in the test booklet for extended stretches of time. He would only look at the items—he would not try to work out the problems nor initiate creative solutions.

On the self-efficacy survey he indicated “definitely true” that many students in math class can work problems faster than him. He indicated “mostly true” that even when he studies very hard, he still does poorly in math. He indicated “definitely false” that he is not a good math student and indicated on multiple questions that others in his life (family members, teachers, and students) have expressed confidence in his math abilities.

The need to do long division generated severe angst for Bobby and he would regularly refuse to complete the steps of problem-solving when he reached this point. He would throw down his pencil, look away, or engage in some other avoidance strategy. As this algorithm was incorporated regularly in the 7th grade curriculum, this behavior recurred frequently. He even rejected attempts to be taught alternative approaches to this operation.

Another dramatic illustration of his resistance occurred on many occasions when the teacher would assign a task or assignment. He would throw his head back and exclaim, “No!” Such demonstrative reaction was also manifested most dramatically through physical response when the teacher provided feedback to him regarding his mathematical errors. He did not receive the feedback to improve his understanding, but rather

would sulk, argue, or throw down his pencil. Following such instances, he remained reluctant to re-engage in learning math. With these extreme responses, Bobby’s self-efficacy for math was often visibly revealed.

Findings

The theoretical framework for this study, based upon the 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 (see Figure 2) 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).

From the data collected and continuously analyzed throughout the study, conceptual categories emerged reflective of students’ levels of self-efficacy and their agency for modifying their self-efficacy (see Figure 1). The selectively low category attributes self-efficacy in particular instances. A student in this category would display times of successes and failures that raise and lower efficacy or may respond inconsistently to the influence of external factors such as encouragement or criticism. The consistently low category represents a recurring pattern of low self-efficacy in almost all circumstances. The inability to substantially access the four sources of self-efficacy contribute to this category. The malleable category reflects a vacillation of levels of self-efficacy with some affirming response to efforts to alter a level, yet unable to consistently raise efficacy appraisals. The resistant category incorporates a purposefully negative response to efforts to raise efficacy appraisals through an unwillingness to recognize experiences in a way that contributes to enhanced self-efficacy. The findings presented address the four sources of self-efficacy by analyzing the students within these conceptual categories.

–Mastery Experiences

Lack of, or inconsistent mastery experiences contributed to low self-efficacy for math among these students. 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. Sometimes referred to as a "Swiss cheese" math understanding, these holes impede students' abilities to master math concepts as they progress through years in school. In each of the four students, previous assessment results 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 that their experiences yielded some instances of mastery experience but the successes were interrupted by extensive failures. In the case of Adam, he lacked a rich set of authentic mastery experiences as his perception of mastery did not necessarily align with the evidence (his assessment scores, his inaccurate problem-solving approaches). Jillian and Abbey both represent inconsistency of success that impedes the internalization of authentic mastery experiences. 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.

–Vicarious Experiences

In all four of the students the presence of vicarious experiences provided evidence of influence upon their self-efficacy. Comparison with a model plays an important role in the formation of vicarious experience as students perceive others (models) and draw comparisons with themselves (Bandura, 1986). For Adam, his younger brother's acumen for math spurred him to desire success in math and served as a means of self-comparison. Additionally, when the teacher utilized grouping for learning activities, the negative vicarious influence of other students inhibited his willingness to engage in learning. This dynamic led to cautious teacher decision-making regarding grouping arrangements for Adam as his sensitivity to the influence of others contributed to his level of self-efficacy.

We observed a contrasting effect with Bobby. Zimmerman (2000) asserted, "If a model is viewed

as more able or talented, observers will discount the relevance of the model's performance outcomes for themselves" (p. 88). Such was the case for Bobby as his twin brother's success in math did not serve as a model for him to attain, but rather he avoided any comparison, discounting the effect on himself. In fact, when his parents recommended that Bobby ask his brother for help with math, Bobby refused and became visibly upset. Jillian recognized the status of other students and was highly sensitive to her positioning in relation to them. Instead of motivating her to learn math, this awareness reinforced her low self-efficacy. Abbey's vicarious experiences contributed to her malleable self-efficacy from her friendships with other students—those who had high achievement and others who had low achievement in math.

Such responses of students toward vicarious experiences can provide important context for teacher decision-making related to student grouping. The influence of other students can impact students' perception of themselves and either promote or mitigate learning opportunities. Careful consideration by the teacher of grouping arrangements may preclude vicarious experiences that diminish self-efficacy.

–Social Persuasions

The influence of social persuasions contributed to the low self-efficacy for these students. Bandura (1986) explained that social persuasions can influence successful performance if the persuasion is perceived within realistic bounds. Since these students lacked refined skills to make accurate self-appraisals, the sway of others (teacher, students, or family members) impacted their level of self-efficacy. The interactions of the teacher with the students to encourage, offer correction, and motivate demonstrated efforts to employ persuasion while providing illustration of the attributes and limitation of such persuasion. Adam's heightened sensitivity to encouragement from his teacher and his awareness of the discouragement from peers demonstrated the competing effects on the level of his self-efficacy. This affirms Bandura's (1986) claim that "it is probably more difficult to produce enduring increases in perceived efficacy by persuasive means than to undermine it" (p. 400). The influence of his peers and others may have, indeed, undermined his efficacy more than his teacher bolstered it.

Jillian offered a vivid illustration of an inaccurate self-appraisal resulting from her dependence upon others to provide evaluation of her ability through her recurring attribution of the nature and ability of the students in her math class (and her included). Abbey and Bobby both depended greatly upon the feedback of the teacher for encouragement (positively in Abbey's case) and for direction (negatively in Bobby's case). Such reliance upon the teacher illustrates the influence of social persuasion on their self-efficacy.

–Physiological States

The physiological states generated within each of these students contributed to their low self-efficacy. Bandura (1986) attributed such states as anxiety, stress, fatigue, and mood. When doing math, each of these students demonstrated such intense physiological responses as those identified. Such feelings as anxiety can negatively impact self-efficacy and can lead to strong responses to tasks that generate these feelings. The four students revealed varying reactions to learning math: Adam experienced feelings of pleasure from solving problems; Jillian became anxious while in math class; Abbey displayed much enthusiasm when she experienced success, and Bobby demonstrated physical reactions when asked to learn math. For each of the students, the intensity of their physiological states revealed the presence of this source of self-efficacy.

The theoretical framework provided a means for distilling the findings of this multi-case study of four historically low-performing 7th grade students in a math class at an urban middle school. Evidence within the four sources of self-efficacy (mastery experiences, vicarious experiences, social persuasions, and physiological states) illuminates these findings of the causes of low self-efficacy for math for this group of students. From identifying the causes for these students, we can explore the implications and consider suggestions in a discussion of how to serve students similarly situated.

Discussion

So, are these students and others similarly situated destined to low achievement in math? Not necessarily as self-efficacy beliefs can change. Zimmerman (2000) asserted that self-efficacy is “responsive to changes in personal context and outcomes, whether experienced directly,

vicariously, verbally [through persuasion], or physiologically” (p. 88). By identifying the causes of their low self-efficacy, we can more fully understand the impediments to learning math. From this understanding, we present implications for teacher practice and for Christian educators.

–Implications for Teacher Practice

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, form a nurturing classroom environment, and employ feedback mechanisms that reflect an awareness of students' low self-efficacy.

Building confidence in students with low self-efficacy offers a vital aspect of instruction. Boaler (2003) affirmed this notion: “Research tells us that confidence in one's ability to succeed in mathematics is an intrinsic part of success and motivation” (p. 505). Motivation that inspires such students toward learning math cannot be limited to verbal persuasion as exhortations of, “You can do it!” or promises of, “I believe in you!” From previous literature on self-efficacy (Bandura, 1986, 1997; Zimmerman, 2000), verbal persuasion has offered a limited impact on changing students' self-efficacy. Persuasion of this type can be undermined by competing information, such as low scores on assessments that discredits the one offering the persuasion—in this case, the teacher. Therefore, a teacher should direct the motivation in a way that offers support to students under conditions that generate successful experiences in order to build their confidence. When students experience success, then the encouraging motivation offered by the teacher is affirmed and validated in the beliefs of the students.

Low self-efficacy for math contributes to the amount of effort students invest, the extent of their persistence with solving math problems, and the degree of perseverance with challenge (Pajares, 1997). Learning math demands persistence with challenge and even creativity with problem-solving, so when students lack these attributes, teachers face a dilemma. Creating a classroom environment that encourages persistence and creativity can help overcome these deficits. A study of self-efficacy

and classroom environment upon student achievement indicated that classrooms perceived by students as caring and challenging contributed to higher levels of student achievement (Fast et al., 2010). From their study, Fast et al. derived that caring and challenging classroom environments positively affected math self-efficacy. Therefore, nurturing environments based upon these attributes may prove more constructive than competitive dynamics that function by drill and practice.

Competitive arrangements that reward speed and accuracy will not substantially help these students as these tactics diminish their desire to engage because they see that they cannot win. Rather, encouraging students to work deliberately and to exercise their own distinct problem-solving approaches without immediate definitive correction can provide a means for these students to attempt math and learn to persist. Please note that we are not encouraging teachers to condone mathematical error and further contribute to inaccurate mathematical thinking. Many students already have fossilized errors in their own reasoning. However, their low self-efficacy evidences their unwillingness to persist and persevere as they see little likelihood of success emerging from extended effort. The study by Sakiz, Pape, and Woolfork Hoy (2012) further illustrated the relation between how students perceive their learning environments for math and their academic hopelessness, recognizing the impact of hopelessness upon self-efficacy. Sakiz et al. concluded that perceived teacher support that included caring, valuing, and encouraging “may contribute to positive changes in students’ perceived motivational outcomes” (p. 248). Therefore, teachers need to create classroom environments in which students can begin to witness the personal value from investing much of themselves in the process of learning math.

A critical role of learning math involves receiving feedback. The binary nature (“correct” or “incorrect”) of a traditional approach to solving math problems lends toward poignant responses to student-generated answers. Since students with low self-efficacy have experienced recurrence of failure due to a lack of, or inconsistent frequency of, mastery experiences, the nature of the feedback a teacher provides will mitigate the contentious manner in which students receive correction. When a teacher possesses an awareness of students’ low

self-efficacy, they can construct feedback mechanisms that encourage students toward accurate mathematical thinking. Wiliam (2011) distinguished 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).

For instance, the use of descriptive feedback on student work that guides a student toward what they already know to help solve a problem can prompt them toward the correct solution. This builds upon the mastery experiences that they do have rather than reminding them (through the dreaded red ink or “X” marking incorrect) of their many failures. Reinforcing rudimentary math skills through engaging activities (rather than repetitive drill) can also illustrate supportive avenues for feedback. These students are very aware of the fact that they lack basic math facts; therefore, a teacher’s response to accompanying deficits requires strategic feedback that stimulates students’ learning of elementary skills rather than revisiting their past (and present) inadequacies.

As we saw in the four students portrayed, the aspect of physiological and emotional states was often connected to their receptivity to feedback. Usher (2009) asserted 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.

–Implications for Christian Educators

Bandura’s (1986) Social Cognitive Theory provided a means of considering human functioning; however, integration with a biblical perspective is

necessary to arrive at an aligned understanding of the needs of students. On its own, this theory does not reflect a Christian worldview and acceptance would discount the critical missing components, namely the need for redemption. A set of beliefs about one's self that is inconsistent with the teaching of Scripture offers a false outlook upon the human condition providing little grasp upon the eternal significance of the experiences of people. As asserted at the outset, mathematics provides a vital means of intersecting with God's revelation through Creation offering a segue to understanding salvation. From this position we can capture the importance of this academic discipline for all students. Students such as those portrayed in this study disengage with learning math as a result of a number of factors, including possessing low self-efficacy. By recognizing this contributing factor, teachers can employ approaches that re-engage their students to learn math and to marvel at Creation.

Christian educators called to serve discouraged students have a tremendous opportunity. To effectively serve students, such as the ones in this study through math instruction and Christian witness, we need to understand their experience including their beliefs about their own abilities. The Christian educator's access point is a math classroom—the vehicle for transformative influence is responsive instruction that addresses the causes of low self-efficacy. As asserted previously, verbal persuasion and encouragement does not provide enough influence to alter the deficits and to stop the perpetuation of failure. Additionally, the complexity of students' experiences as they arrive at school can confound the most well-intentioned educators. However, an understanding of the causes of low self-efficacy can inform the approaches that an educator takes to serving their students.

Conclusion

When we can identify the causes of low self-efficacy for math, we hold a better position for offering remedy to students who struggle to learn math. The four students portrayed in this multi-case study provide a glimpse at the causes of low self-efficacy in light of the four sources promoted in Bandura's (1986) Social Cognitive Theory. According to Bandura, 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.

It is our hope that the findings of this study can provide educators with insights into the causes of low self-efficacy for students and allow researchers to theorize about a broader set of cases related to learning math. Generalization may exceed the scope of this study; however, application of the findings may support other students similarly situated. For teachers serving students with low self-efficacy for math, understanding the causes can guide decision-making regarding approaches to instruction, motivation, and feedback in the classroom.

For Christian educators, a fuller understanding of the personal experiences of students allows for intentional service to the children in their charge. Children such as these are discouraged of their prospects, marginalized in their educational experience, and tenuously engaged in school. When teachers can re-engage them in the study of math, they open that window and change the outlook of students so as to keep them open to explore Creation.

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