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The Mathematical Disposition Of Middle School Students: An Examination Of Students' Self-Concept Of Ability In Mathematics

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THE MATHEMATICAL DISPOSITION OF MIDDLE SCHOOL STUDENTS:

AN EXAMINATION OF STUDENTS' SELF-CONCEPT OF ABILITY IN MATHEMATICS

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ABSTRACT

The purpose of this mixed methods case study was to answer the following research questions via the lens of social-constructivism: How do middle school students describe their self-concept of ability in math? What teacher/classroom interventions are recognized by students as having an impact on their self-concept of ability? This study specifically addressed the utilization of student voice and the need to recognize self-concept of ability as a separate academic domain in research. The purposeful sampling for this case study consisted of 10 eighth-grade middle school students who participated in both an online survey and a semi-structured interview. The major themes that emerged from participant responses included 1) self-concept of ability, 2) multidimensionality of attitude, 3) significance of grades, 4) academic press (the pressure to achieve), 5) feedback and reinforcement, 6) social support and 7) modifying the learning environment. From these themes conclusions were drawn and recommendations were made those planning instruction to address the malleability and fluctuation of middle school students' self-concept, the lack of consistency self-concept has in helping to define one's positive mathematical disposition and the students' identification of successful interventions deemed positive in their self-concept development. The conclusions are transferable to other mathematical settings and provide research that is foundational for future studies. Recommendations outline a need for changes in math education that students feel is necessary for their academic success.

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CHAPTER 1

INTRODUCTION

This study tests and expands current research that indicates a student's positive mathematical disposition plays a crucial in mathematical success. The National Council for Teachers of Mathematics described one's mathematical disposition as a student's ability to think and act in positive ways towards mathematics (National Council of Teachers of Mathematics, 1989). Everyone has a mathematical disposition. According to researchers Nicolaidou and Philippou (2003), when students first begin school they tend to have a positive disposition towards mathematics. However, Köğce, Yıldız Aydın, & Altındağ (2009) found considerable increases in negativity towards mathematics within middle school students where eighth graders were significantly more negative towards mathematics than sixth graders. The identification of middle school as a pivotal moment in the development of a student's negativity towards mathematics is alarming as a student's negative disposition correlates with lower math achievement, decreased interest in math courses, and diminished interest in science, technology, engineering and mathematics (STEM) related careers (Beyers, 2011).

The examination of a student's mathematical disposition points to the importance of the affective domain of one's mathematical disposition, referred to as a student's attitude towards mathematics. Research by Lipenvich, MacCann, Krumm, Burrus and Roberts (2011) highlighted "the importance of non-cognitive variables in predicting academic achievement with mathematics attitudes explaining from 25% to 32% of the variance in mathematics achievement with much of the explained variation independent of mathematics ability" (p. 114). Di Martino and Zan (2011) recognized such studies as essential in understanding the development of a student’s positive mathematical disposition; however, their analysis showed that a student's negative disposition towards mathematics could be associated with a student’s self-beliefs in mathematics: self-concept of ability.

There is an abundance of literature explaining why middle school students experience decreases in a positive mathematical disposition. Age, gender, socio-economic background, and culture play significant roles in the development and stability of a student’s positive mathematical disposition (Marsh, Abduljabbar, Parker, Morin, Abdelfattah, Nagengast, & Abu-Hilal, 2015; Pinxten, De Fraine,Van Damme, & D'Haenens, 2013; Wang, Osterlind, & Bergin, 2012). The overarching purpose guiding these studies is based on achievement in mathematics and the search for answers about how progress in math achievement can be made.

Math achievement and positive disposition research demonstrate a consistent relationship between a student’s positive self-concept of ability in mathematics and math achievement (Hannula, 2002; Pietsch, Walker, & Chapman, 2003). Researchers including Marsh and Craven (2006), Marsh, Trautwein, Lüdtke, Köller and Baumert (2005), as well as Seaton, Parker, Marsh, Craven, and Yeung (2014), point to a strong relationship between domain specific achievements and self-concept over global achievements and self-concept. A student’s self-concept of ability in mathematics has a stronger correlation to math achievement than the general self-concept of ability correlates to math achievement. Irrespective of the relationship between achievement and self-concept being content specific, there is limited work focused on specific interventions that impact a students’ self-concept of ability in mathematics.

The implementation of interventions, specifically those aimed at academic skill improvement, is a natural and common avenue when searching for improvements in math. McInerney, Cheng, and Lam (2012) pointed to an alternative path by stressing the importance of self-concept as related to the improvement of student academic achievement. Interventions designed to improve students' academic skills do not have a long-lasting effect on students' self-concept of ability (Arens, Yeun, Craven, & Hassellhorn, 2011). Successful interventions go beyond strengthening academic skills and include domain specific improvements to a student's self-concept. In fact, O'Mara, Marsh, Craven, & Debus (2006) stated "it seems timely for researchers and practitioners to capitalize on developments in multidimensional self-concept theory and instrumentation to create an array of interventions that target domain specific facets of self-concept" (p. 201); in this case, interventions aimed at the improving the self-concept of students in mathematics using a combination of both indirect and indirect methods.

The intent of this study is to document the self-concept of middle school math students and the interventions students identify as having an impact on their self-concept of ability. Research on students' poor self-concept supports a need for interventions, aimed at the intersection of self-concept and achievement; to make progressive changes in attitude helps to define the worthiness of this instrumental case study. By examining middle school students' self-concept and asking for students' perspectives about which teacher/classroom interventions they perceive to have positive impact on self-concept development, there exists the potential to make positive changes in the negative mathematical dispositions of students.

The consequences of negative attitudes reach beyond the middle school classroom. At the college level, about 1% of undergraduate students majored in the field of mathematics from 1990 to 2000, during which time college enrollment rose 9% (Tapia & Marsh, 2005). This presents a problem for the future, as fewer students appear to be seeking degrees in mathematics leading and STEM careers. There is value in gaining the perspective of students to determine what can be done to break down the walls of negativity towards math, increase achievement, and ultimately prepare students for futures in STEM careers.

According to Bandura (2006), modern theorists consider middle school years as a period when self-concept of ability becomes more stable. Di Martino and Zan (2010) felt a student's relationship with mathematics is rarely described as stable and that "it is never too late to change students' attitude towards mathematics" (p. 27). As a middle school teacher, there is value to be found in gaining the perspective of students to determine what can be done to break down the walls of negativity towards math, increase achievement and ultimately prepare students for futures in STEM careers.

This introductory chapter provides readers with the statement of the problem and the purpose of the study, as they are related to the development positive mathematical dispositions of students. Research questions are then tied to the purpose of examining the self-concept of middle student and delineating the scope of this mixed methods cased study to support the transferability of findings via the lens of social-constructivism and the domain specific, hierarchical model of self-concept. The chapter concludes by reaffirming the purpose of the research prior to a review of literature in Chapter 2.

Statement of Problem

A key problem in mathematics education exposed by research is the decrease in a positive mathematical disposition during middle school years. Loss of a positive attitude (or lack of development of confidence in math learning) has long-term negative outcomes on high school math course selection, interest STEM majors at the college level and interest in STEM related careers. A student's positive mathematical disposition or attitude, generally defined as a student's emotions as well as beliefs and behaviors towards mathematics, is said to play a crucial role in learning mathematics (Hart, 1989; Neale, 1969). As a result, studies have focused on the relationships between mathematics achievement and attitudes in mathematics raising a concern that as students progress in years of schooling their attitudes towards mathematics increase in negativity (Ma & Kishor, 1997). Researchers have found a similar pattern of negativity in the mathematical self-concept of students (Wilkins, 2004; Reyes, 1984).

The affective domains of learning such as self-beliefs and attitudes are crucial to mathematics achievement. Defined as a student's perception or belief to do well in mathematics and confidence in learning mathematics, researchers suggest a causal relationship amongst the constructs of mathematical self-concept of ability, attitude, and achievement (Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005; Möller, Pohlman, Koller, & Marsh, 2009; Wilkins, 2004). Studies indicate reciprocal relationships amongst positive attitudes, beliefs towards mathematics, and academic success and more specifically the existence of a strong relationship between students' mathematics achievement and self-concept of ability (Ashcraft & Krause 2007; Awad, 2007; Cokley & Moore, 2002; Guay, Marsh, & Boivin, 2003; Huang, 2011; Ma & Xu, 2004; Matovu, 2014; Marsh, et al., 2005; Marsh & Craven, 2006; Marsh & Yeung, 1997; Valentine, Dubois, & Cooper, 2004; Wang, Osterlind, & Bergin, 2012; Yoshino, 2012).

According to Gottfried et al. (2013), "the most effective math programs incorporate motivationally relevant instruction supporting the use of instructional methods incorporating both achievement related and motivational interventions" (p. 85). Additional research has shown that interventions can have a direct effect on the intrinsic motivation of students and are directly related to the attitudes of students (Hassan, Hassan, Ching, & Hamizah, 2012). In fact, these constructs are recognized as significant in the identification of student accomplishments and intrinsic motivation in mathematics (Gottfried, Marcoulides, Gottfried, & Oliver, 2013; Zollman, Smith, & Reisdorf, 2011).

Understanding these constructs and the impact they have on one another can make a positive impact on student achievement (Bobis, Anderson, Martin, & Way, 2011; Green, Nelson, Martin, & Marsh, 2006). There is a lack of research that simultaneously examines how these constructs influence the positive self-concept and positive mathematical disposition of students (Green et al., 2006). And more specifically, little is known about interventions to support the positive self-concept of middle school math students.

Purpose of the Study

The purpose of this mixed methods case study was to examine students' self-concept of ability as it related to the positive mathematical disposition of middle school students' achievement in mathematics. The focus was not how a student's attitude relates to math achievement nor is the intent to prove or disprove the research based on the constructs of age, gender, culture, or mindsets. The intent was to listen to middle school students' stories to document teacher/classroom interventions that can be used to enhance middle school students' self-concept of ability in mathematics and further support the development of positive mathematical dispositions of students.

Students positively benefit from self-concept enhancing interventions, which can significantly boost their self-concept of ability in mathematics (O'Mara et al., 2006; Pinxten et al., 2013). However, a review of literature shows a gap in math research incorporating student perception regarding self-concept of ability in mathematics (Attard, 2013). Observations of children who differ in aspects of reported self-concept, ratings of children's performance by teachers or parents, or open-ended interviews in which children report what they do and how those activities relate to their self-perception need to be used in self-concept research in order to get a sense of self in action (Wigfield & Karpathian, 1991). In order to gain a sense of self in action, self-concept research needs to include the perspective of students via a) student self-concept ratings b) open-ended student interviews, and c) purposeful samplings.

Changing instruction and re-culturing schools may support closing gaps in middle school math. The objective is to provide the middle school community with a relevant and rigorous study to deepen the educational arena's understanding of self-concept, as it relates to a student's positive mathematical attitude and positive disposition development. Adolescents need knowledge, skills and attitudes that will help them to be successful in mathematics if there is hope for increased achievement. With the contribution of this research, teaching and learning practices at the middle level can be improved upon to support the problem of low math achievement in United States.

Research Questions

The overarching focus of this study was on the decrease in positive mathematical disposition seen during the middle school years. Literature addresses the intersection of self-concept of ability and achievement in mathematics; however, literature lacks in its usage of student voice. Little research uses the perception of students to document teacher/classroom interventions that can be used to support the development of positive self-concepts in students. The following research questions were designed to support these areas lacking in math research:

- How do middle school students describe their self-concept of ability in math?
- What teacher/classroom interventions are recognized by students as having an impact on their self-concept of ability?

Conceptual Framework

Students are not born with a positive or negative disposition towards mathematics nor are they born with a positive or negative disposition of mathematics. A student's mathematical disposition is formed by the reciprocal factors of math achievement, academic self-concept of ability and attitude. Negative feelings and experiences pertaining to any of these factors lend themselves to the formation of a negative mathematical disposition.

Students with a positive disposition are expected to be successful in mathematics, have a positive self-concept, and have a positive attitude towards mathematics according to the expectancy-value model (Eccles, Adler, Futterman, Goff, Kaczala, & Meece, 1983). However, it is necessary to note that “even high-ability students who internalize stereotypes about abilities or who adopt familial or cultural views about who can be successful at certain activities are likely to have reduced expectancies in the STEM domains” (Anderson & Cross, 2014, p. 222). Furthermore, students with a negative disposition are expected to have a negative attitude, a negative self-concept of ability, and lack in mathematical achievement.

The social-constructivist lens of learning, however, provides a framework to reconsider the inevitable outcome by suggesting the intervention of teachers and peer can make a positive impact on learning. Through this lens of teaching and learning, a students’ negative mathematical disposition is considered malleable. As students have different experiences in mathematics, their attitudes, self-concept, and achievement change. Guay, Larose, and Boivin (2004) suggested the need for researchers and practitioners to understand the psychological processes and classroom practices that mediate or moderate the academic self-concept to academic performance relation. The basis for this suggestion relies on self-concept of ability being a learned construct. This leaves the door open for supporting positive self-concept development.

The model defined by Marsh/Shavelson guides researchers to narrow their approach of self-concept of ability. Self-concept is acknowledged as being multidimensional and domain specific rather than the unidimensional view. In other words, self-concept is recognized in both academic and non-academic domains, which can each be divided into further facets. Rather than looking at self-concept as one's general belief, the multidimensional approach clarifies the specific academic domain of mathematics allowing for specific achievement studies. The Marsh/Shavelson model supports the foundational need for math-specific interventions. It is the Marsh/Shavelson model that says mathematical achievement is substantially correlated to self-concept of ability in mathematics (Marsh & Shavelson, 1985).

Assumptions, Limitations and Scope

Throughout fifteen years of teaching middle school math, I have heard the statement "I can't do math" time and time again. As described by the social-constructivist lens, this perspective of the student becomes their reality. This statement is a reflection of several factors described in research such as gender, age, culture and socio-economic status. However, to examine all of these factors in a single study is beyond the scope of this research. To gain insight into the self-concept of middle school students and their perspective of teacher/classroom interventions, this case study examines a purposeful sampling of eighth-grade middle students.

Based on my work as a middle school teacher, I believe that middle school students can learn mathematics and everybody can experience mathematical success and achievement. I also understand that not all students have a positive self-concept, attitude or mathematical disposition towards math. According to Bong & Skaalvik (2003), a student's self-concept of ability is defined as relatively stable; however, it is not permanent. This assumption follows from the research of Bandura (2006) as well as Di Martino and Zan (2010). However, I believe that negativity in any or all of these areas can be reversed.

In the search for interventions to support the development of positive self-concept in students, it is assumed that the self-concept of students is not stagnant and can be changed via the implementation of teacher/classroom inventions. Self-concept is a product of internal and external frames such as social supports and the math learning environment. For the scope and purpose of this research, it is understood that there are internal factors to be considered in the development of one's positive mathematical disposition and self-concept. It is assumed, however, that the social-constructivist lens is just as important in developing a positive self-concept. In other words, the development of a positive self-concept relies on an actively involved teacher and peers as they develop the culture of the mathematics classroom and experience.

The qualitative aspect of the case study relies on open and honest responses from participants. It is assumed that the participants from the purposeful sampling felt as if the interviewing relationship between the researcher and the student were safe for open, honest and trusting conversations.

A final assumption is that the sampling of participants chosen for this case study is representative of the eighth-grade population from the setting. The sampling is not intended to be used for generalization of all eighth-grade students, but it is assumed that the variance in the sampling and the selection method gathered a broad enough perspective for the transferability of the findings and conclusions.

Limitations to the study include the demographics and population of the students. The middle school population to be studied consisted of approximately 400 seventh and eighth-grade students combined with the majority of students coming from middle to upper-class families. The relatively homogeneous community narrowed the scope of the demographics for the sampling.

An additional limitation to the study is the small size of the sampling. The initial twelve participants who opted into the study, although relatively small in number, made the completion of research plausible for the researcher in terms of time management. The limitations as described in this context helped to define a preliminary study. Although identified as limitations to the study, the factors described helped to clarify the boundaries case study and further define the scope of the research.

Significance

Nadler (2006), in describing his congruence model of change, pointed out the importance of looking at what is in fact occurring or what has occurred within an organization, in this case, the school. When this perspective is taken, the structure, systems, processes, culture, rules, practices, communication, and behaviors or the overall fit can be better understood and changes put into place to improve effectiveness. In the words of Nadler (2006), “the tighter the fit, the greater the effectiveness” (p. 259). The role of leaders in education is to determine when there is a lack of fit to then look for ways to fill the gaps.

To make a positive impact on mathematics achievement in middle school students, research guides leaders to not only focus on the positive mathematical dispositions of students but specifically the self-concept of these students. Research shows a decrease in mathematical achievement, attitude, and self-concept of ability during the transition to the middle school years. Several factors such as gender, age, race, and socio-economic status can make an impact on these constructs during this time of student development. Nadler (2006) stressed that changing one or two factors will not make everything fall neatly into place. However, it is the responsibility of leaders in education to make attempts to fill the gaps.

If improvements are expected in middle school math achievement, research should extend beyond math skills interventions to interventions that support students’ positive self-concept of ability in mathematics. Examining students' self-concept of ability in mathematics and gaining a perspective as to which interventions have an impact on their self-concept in mathematics can support positive changes in attitudes towards mathematics and math performance. Knowing how the students' experience math learning is key to understanding their feelings towards mathematics, their self-concepts of ability in mathematics, and the perspective of which interventions make an impact on their self-concept in mathematics. Those individuals interested in positive change initiatives in the middle school students' with negative mathematical dispositions and low math achievement may benefit from this mixed methods case study.

Definition of Terms

For the purposes of this study, these are the definition of key terms:

- *Academic Press* is a term used to describe the pressure put on students to achieve. The pressure to be successful comes from various environmental sources. Common pressures come from school expectations, norms, grading practices, sources, teachers and event the students themselves. The culmination of these pressures is described as *academic press* and form the academic environment for the learner (Murphy, Weil, Hallinger, & Mitman, 1982).
- *Attitude* is a complex term with many definitions. For the purpose of this study, attitude will refer to one's feelings *towards* a subject, in this case mathematics, which encompasses the affective domain over effort or cognitive domains. As suggested by Di Martino and Zan (2011) viewing attitude in this manner, as a constructed grounded theory, allows attitude to be defined as positive or negative rather than trying to determine the combination of behavioral, emotional, and/or physical attributes.

- *Interventions* are commonly described as “a set of actions that, when taken, have demonstrated the ability to change a fixed educational trajectory” (Methe & Riley-Tillman, 2008, p. 37). For the purposes of this study, the interventions will refer to classroom and teacher practices implemented for the purpose of improving the negative self-concept of ability in mathematics.
- *Expectancy-Value Model* explains that prior achievement is a predictor of future achievement or what one can expect. Eccles et al. (1983) build on this simplistic term by clarifying that despite prior achievement being a predictor of future achievement, additional factors such as ability, age, parents, and stereotypes are also influential in future achievement.
- *Internal/External Frames of Reference* are the two frames used by Marsh to define the multidimensional domains of self-concept. According to the *internal frame of reference* students evaluate their achievement on any given subject based on their achievements in other subjects (Marsh, 1986). For example, a student may believe he/she has poor math abilities based on his/her a high level of achievements in another subject such as English. The comparison made by the student is based on what he/she defines as achievement in comparison to his/her own successes. The *external frame of reference* is when students make a comparison of achievement socially (Marsh, 1986). For example, a student may determine that he/she is a poor math student based on the high levels of achievement of his/peers.
- *Mathematical disposition* is an individual’s “tendency or inclination to have or experience particular attitudes, beliefs, feelings, emotions, moods or temperaments with respect to mathematics” (Beyers, 2011, p. 71). This disposition can be further defined as

a combination of attitudes, behaviors, motivation, interests, and sense of reality in terms of what is possible in terms of mathematical achievement that can enable or inhibit some forms of learning (Hodkinson, Beista, & James, 2008).

- *Marsh/Shavelson* model defines the multidimensional and hierarchical composition of self-concept. Shavelson, Hubner, & Stanton (1976) defined self-concept as a construct made of both academic and non-academic domains. According to their research, both domains could be further divided into such domains as math, science, and English. Marsh (1986) clarified the domains in his research by clarifying that the self-concept amongst domains is not correlated. For instance, the self-concept of math is related to math achievement, but self-concept of math is not related to achievement in science or English. The reverse can also be defined as true according to this model, where self-concept in English is related to achievement in English but not related to math achievement. The combination of the two frames of thought is defined as the Marsh/Shavelson model.
- *Self-Concept* is a cognitive term used to describe “an individual’s perception or belief in their ability to do well in an academic domain” (Wang et al., 2012, p. 1215). For example, “I am good at math.” Self-concept is the way in which individuals “perceive their strengths, weaknesses, abilities, attitudes, and values” in mathematics (McInerney et al., p. 250).
- *Social-Constructivism* is Vygotsky’s learning theory based on the idea that learning is a social process shaped by external forces where knowledge is formed via interactions with others and the environment (Palincsar, 2005). Of particular importance for this study, is the notion that adults, in this case teachers, and the social context play important roles in student learning.

- *Stage-Environment Fit* perspective suggest that adolescents whose environments change in developmentally regressive ways are more likely to experience difficulties. Those adolescents whose environments respond to their changing needs are more likely to experience positive outcomes (Eccles & Midgley, 1989). Based on this approach, changes in classroom organization, instruction style, task structure and complexity, group work practices, evaluation techniques, motivational strategies, responsibility for learning, teacher-student, and peer-peer interactions contribute to negativity seen in achievement beliefs (Eccles, Midgley, Wigfield, Buchanan, Reuman, Flanagan, & MacIver, 1993).

Conclusion

The decrease in the positive mathematical disposition of middle school students suggests a crucial need for research to examine the self-concept of ability in middles school students. Chapter 1 provides an overview of the purpose of this case study, to examine middle school students' self-concept of ability in mathematics as it is related to the positive mathematical disposition of middle school students' achievement in mathematics. Chapter 1 also discusses the fact that research identifies middle school as a poignant moment in the development of a student's negativity towards mathematics. However, research is still lacking in both the examination of middle school students' math achievement and the development of students' positive mathematical disposition through self-concept of ability in mathematics and the teacher/classroom interventions that are identified by middle school students as playing a positive role in the development of their self-concept of ability in mathematics (Green et al., 2006). Assumptions, limitations, and the scope of research as well as definitions within Chapter 1 support the significance of this study in making a positive change in the mathematical disposition and achievement of students via their self-concept of ability in mathematics; an extension beyond the enhancement of math skills and general self-concept.

Chapters following Chapter 1 provide an in-depth look into this study beyond. Chapter 2 situates the study of middle school students' self –concept of ability and supporting interventions within the context of previous literature and research. Vygotsky's social-constructivist theory of learning and the Marsh/Shavelson model of self-concept provide the conceptual framework for this study and are further discussed in Chapter 2. In conjunction with the conceptual framework, the critical synthesis of literature in Chapter 2 addresses the gaps in literature and demonstrates how this study contributes to existing research. Grounded in the conceptual framework, Chapter 3 shares the mixed methods methodology approach selected for this instrumental case study and the focus of transferability that resulted from the use of qualitative methods. The organization of results, and the analysis of the data can be found in Chapter 4. Chapter 5 then provides detailed conclusions to contextualize the data and makes recommendations for future research, and concludes with a summary of the importance of the completed research.

CHAPTER 2

REVIEW OF LITERATURE

The development of science, technology, engineering, and mathematics (STEM) fields have given rise to a vast amount of research related to student achievement, interest, and accessibility related to STEM coursework. However, 74% of college graduates with STEM degrees are going into non-STEM jobs, according to the United States Census Bureau (2014), with the result that STEM jobs lack qualified U.S. applicants. The President's Council of Advisors on Science and Technology (2010) recognized that the problem extends beyond educational standards or a lack of proficiency amongst American students. There is a lack of interest in STEM fields amongst American students with only 16% of high school seniors interested in pursuing STEM careers, according to the United States Department of Education (2014). These are STEM jobs that U.S. companies consistently struggle to fill, more so than their non-STEM counterparts (Rothwell, 2014). To support this critical time in the STEM fields, there is a need for research focused on the negative mathematical disposition that is turning so many American students away from STEM fields and careers. This literature review narrows this large topic and centers on how middle school students feel about themselves as learners of mathematics, their self-concept of ability in mathematics.

Researchers have paid particular attention to student attitude. One of the factors that affects students' math achievement is a students' attitude as it plays a crucial role in learning process, especially in the core subject of mathematics (Yilmax, Altun, & Olkun, 2010, p. 4502). Literature suggests that students are more likely to have a negative attitude towards math and science in comparison to other academic areas (Hannula, 2002; Ma & Kishor, 1997). Following from these findings, Rice, Barth, Guadagno, Smith and McCallum (2013) summarized in their research that attitudes towards science and mathematics follow different paths over adolescence, which aligns with the work of Else-Quest, Mineo, and Higgins (2013) who suggest attitudes and achievement in math be distinguished from those in science. As suggested by Barth, Todd, McCallum, Goldston, Guadagno, Roskos, and Burkhalter (2011), this literature review examines attitude and achievement within the distinct academic domain of mathematics, separate from other STEM fields.

In the United States, students' negative mathematical self-concept becomes prominent around the middle school years. This appears as a natural consequence of the decline in students' beliefs in their abilities to perform within the field of mathematics as they move through school. Wigfield and Karpathiann (1991) suggested "the middle school years are a time of important change in children's self-concepts as they move from describing themselves in physical and behavioral terms to incorporating more psychological aspects into their self-concept" (p. 250). Current research has not ignored this period of change in self-concept and focuses on the periods of time immediately before and/or after the transition to middle school (Parker, 2010). What is lacking is the focus on students' self-concept of ability in mathematics *during* middle school. This limitation in the research suggests the importance of additional studies related to middle school students' self-concept of ability in mathematics *during* middle school.

According to Choi, Choi and McAninch (2012) "it is crucial to consider the priority of education – students scoring higher, or fostering a psychologically balanced view of themselves and achievement" (p. 198). Academic self-concept, attitude, and achievement are three components acknowledged in research as essential to student success and in forming positive mathematical dispositions (Pinxten et al., 2013). Self-concept, however, is one of the major predictors of achievement and as STEM achievement increases, the student's self-concept increases, and interest in STEM increases (Guay et al., 2003; Nagy, Trautwein, Baumert, Koller, & Garret, 2006; Skaalvik & Skaalvik, 2002).

Research recognizes the decline in positivity and increase in negativity as it is related to middle school students' mathematical self-concept, achievement and attitude during the middle school years. While research is plentiful in achievement and attitude studies, there is also an abundance of research that has specifically focused on self-concept, the susceptibility of self-concept to change during the middle school years and the direct impact self-concept has on a student's attitude and achievement (Baldwin & Hoffmann, 2002; Möller et al., 2009; Mars et al., 2005; Wilkins, 2004). As a result, researchers have suggested that interventions need to focus on specific dimensions of self-concept, however, there are limited studies who have done such and particularly a limited number of studies that have focused on interventions to support positive development in a middle school student's self-concept of ability in mathematics (O'Mara et al., 2006).

Attard (2013) additional found that there are few studies in mathematics that incorporate student voice with the intention of improving teaching practices. Self-concept researchers are now beginning to recognize the potential benefits of tapping into the perceptive of self. Through his review of literature, Byrne (2002) determined "that there was a grave need for researchers to move beyond the paper-and-pencil approach to self-report measurement" (p. 904). Wigfield and Karpathian (1991) further suggested interviewing students who differ in aspects of reported self-concept to better understand how activities relate to a student's sense of self. With a lack of student perspective, the validity of student voice is considered.

This review of journal articles, books, and previous research concentrates on the development of middle school students' positive mathematical disposition via the social-constructivist lens and the affective domain. To begin the review, the composition of a student's mathematical disposition, whether it be positive or negative, is described as a multi-dimensional, hierarchical construct impacted by internal and external frames. Self-concept is then explained as a dynamic construct of reciprocal relationships amongst itself, achievement, and attitude. The review then addresses research that supports the development of self-concept in students lending to the discussion of interventions used in the middle school learning environment for mathematics focused on improvements in self-concept of ability. The result is a discussion of how a student fits into this learning environment and the self-concept interventions that impact the middle school math student.

The themes derived from the review of literature direct the purpose of this case study; to examine the self-concept of ability as it is related to the positive mathematical disposition of middle school students' achievement in mathematics and the documentation of student identified teacher/classroom interventions aimed at supporting positive development in self-concept of ability in mathematics.

The Composition of a Student's Mathematical Positive Disposition

A common assumption is learning in math is reliant on the cognitive domain where achievement and success in mathematics depends on skills and knowledge attainment. In alignment with social-constructivist learning theory, learning and achievement in mathematics rely on a combination of both affective and cognitive domains where the affective domain explores the development of one's mathematical disposition according to attitude, self-concept of ability (a belief), and achievement (Palincsar, 2005). It is the affective domains of attitudes and belief that help to form a student's reaction towards math and therefore represent the key elements in the development of a student's mathematical dispositional (Beyers, 2011). As a result, a student's disposition towards mathematics can be defined as a multidimensional construct that can enhance learning as well as inhibit the learning of mathematics, depending on the affective perspective taken by the student (Hodkinson et al., 2008).

Attitude

A student's attitude towards mathematics resides within the affective domain (McLeod, 1992). A simple definition of mathematical attitude is the learned tendency or predisposition to respond in a consistently negative or positive manner towards mathematics, a positive or negative emotional disposition toward mathematics. The bi-dimensional definition recognizes attitude as a pattern of beliefs and emotions associated with mathematics. The multi-dimensional perspective of attitude recognizes the combination of the emotions, behaviors, and beliefs towards mathematics based on factors such as perceived competence and vision of mathematics.

Researchers do not agree on a common definition for attitude. Neale (1969) defined attitude towards mathematics as "a liking or disliking of mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless" (p. 632). Aiken (1970) defined one's attitude towards mathematics as "a learned predisposition or tendency on the part of an individual to respond positively or negatively to some object, situation, concept, or another person" (p. 551). McLeod (1992) distinguished between beliefs, attitudes, and emotions as three separate components of affect and defines attitude as "affective responses that involve positive or negative feelings of moderate intensity and reasonable stability" (p. 581). As suggested by Kulm (1980), "it is probably not possible to offer a definition of attitude toward mathematics that would be suitable for all situations, and even if one were agreed on, it would probably be too general to be useful" (p. 358). For the purpose of this study, attitude can be understood as a working definition.

The importance of attitude is not in determining a global definition. This perspective allows researchers and practitioners to utilize attitude as a useful tool "capable of taking into account problems typical of mathematics education" (Daskalogianni & Simpson, 2000; Di Martino & Zan, 2003, p. 452; Di Martino & Zan, 2011). However, Philipp (2007) summarizes attitude as "manners of acting, feeling, or thinking that show one's disposition or opinion" (p. 259) that in turn plays a critical role in the learning of mathematics (Neale, 1969), which aligns well with the focus of this research.

Self-concept of Ability

Self-concept of ability has been a focal point in educational research for decades due to its relationships with achievement, success, motivation, and behavior (Guay et al., 2003; Caskey, 2010). Self-concept of ability is particularly important for understanding math achievement because it has been identified as a key factor in not only math achievement but also in course and career selection (Plante, O'Keefe, & Théorêt, 2013).

Self-concept of ability is defined as "an individual's perception or belief in their ability to do well in an academic domain" (Wang et al., 2012, p. 1215). It is one factor said to influence an individual's belief and perception of strengths, weaknesses, abilities, and attitudes to learn and do well in mathematics. Möller et al. (2009) stressed that self-concept has an important effect on the way students "feel about themselves, their accomplishments, persistence, and educational decisions" (p. 1130). As a result, this psychological concept can add great value in understanding the various aspects of learners including their mathematical disposition.

Defining Self-Concept of Ability Through Theory

The Shavelson model portrays self-concept as a hierarchical and multidimensional structure. At the apex of the structure is the global self-concept or the individual's general perception of self. Two separate areas, *academic* and *non-academic*, define global self-concept. Academic self-concept of ability consists of an individual's belief to perform well in subject specific domains, such as math, science or English. The non-academic area consists of the *physical*, *social*, and *emotional* aspects of an individual. Each facet divides further to more specific sub-areas of self-concept. Self-concept is split into the subareas of *peers* and *significant others* such as parents where physical self-concept contains the subareas of both *physical ability* and *appearance*. This division into subareas is additionally seen within academic self-concept as well. Mathematics self-concept of ability, specifically, separates into the facets of self-perceived competence and affect. As a result, self-concept is commonly recognized as a domain-specific, multidimensional and hierarchical construct amongst researchers.

Marsh/Shavelson Model

The Internal/External model (I/E model) of Marsh helps to clarify the comparison of the academic domains proposed by Shavelson, termed as *dimensional comparisons*. The basic idea of the I/E model is students form perceptions of their own academic competence based on two sets of comparisons or frames: an external frame where students compare their abilities in mathematics with the abilities of other students and an internal frame where students compare their individual abilities in math to their individual abilities in another subject (Byrne, 1996).

The internal/external frames of reference define the Shavelson model and further combine to create Marsh/Shavelson model as shown in Figure 1. The Marsh/Shavelson model has been described as "the most profound conceptual advancement in self-concept research" due to the “replicated findings that have grounded this multidimensional structure within in a theoretical framework” (Byrne, 1996, p. 898). According to Green et al. (2006) the research related to the multidimensional approach substantiates the validity of the structure itself and its importance in education.

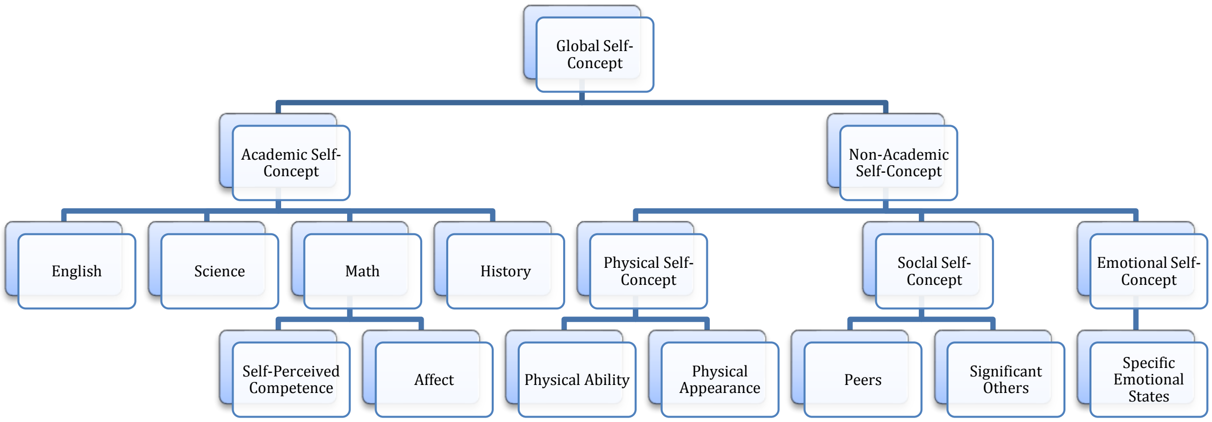

Figure 1. Multidimensional and hierarchical Marsh/Shavelson model of self-concept

The I/E model was developed to compare the domains of math and English because individuals tend to identify themselves as either strong in math or strong in English but not typically strong in both (Marsh, 1986). Few studies, however, have used the Marsh/Shavelson model to investigate mathematics and non-verbal subjects as individual domains instead of comparisons despite research that states those students who are comparatively low in the area of mathematics achievement are expected to have low levels of self-concept (Marsh et al., 2006). This lack of study leaves room for researchers to expand the application of the I/E model and “take into account the multidimensionality of academic self-concept in terms of domain specificity and focus explicitly on self-concept measures at the subject level” (Pinxten et al., 2013, p. 159).

Reciprocal Effects Amongst Self-Concept, Attitude, and Achievement

The reciprocal effect is a model for the direction of relations between attitude, achievement, and self-concept. The assumption under this model is that each of the three factors impacts the other. A positive impact on one construct therefore poses a positive change in the other constructs. This perspective differs from the top-down and the bottom-up models of Marsh and Yeung (1997) where one construct has direct power over the other two. Relying on the reciprocal model provides a lens into the development of a positive mathematical where one's positive disposition towards mathematics is contrived of interwoven constructs.

Self-concept and Achievement

Self-concept of ability and achievement in mathematics are reciprocally related where self-concept affects achievement and achievement affects self-concept (Guay et al., 2003; Marsh & Craven, 2006; Marsh et al., 2005). Prior academic self-concept predicts subsequent academic achievement "beyond what can be explained in terms of prior measures of academic interest, school grades, and standardized achievement test scores" (Marsh et al., 2005 p. 412). These same authors share that through skills development, the inverse relation where self-concept development is a result of prior achievement has also been shown to be true. This reciprocal relationship stresses the particular importance in understanding mathematics achievement in conjunction with self-concept.

According to a study conducted by Wilkins (2004), there is an overall positive causal relationship between the constructs of self-concept and achievement globally. The existence of a reciprocal effect where self-concept predicts future achievement and prior achievement affects self-concept adds validity to the study of self-concept in understanding math achievement (Choi et al., 2012; McInerney et al., 2012; Valentine et al., 2004). In fact, self-concept is "the only identical pattern of prediction of eighth-grade students' mathematics achievement" across the countries of United States, Russia, South Africa, and Singapore defining self-concept as one of the strongest predictors of mathematics achievement in both the near and distant future of students making it advantageous to use self-concept to develop an understanding of students learning (Else-Quest et al., 2013; Valentine et al., 2004; Wang et al., 2012, p. 123; Yoshino, 2012). Relying on the expectancy-value model, self-concept of ability is defined as a strong predictor in achievement having a positive relationship with mathematics achievement.

Attitude and Achievement

Students' attitude towards the subject of mathematics impacts a students' math achievement (Yilmaz et al., 2010). Hemmings, Grootenboer, and Kay (2010) found both prior mathematics achievement and attitudes towards mathematics to be significant predictors of future achievement in math. Similar to the reciprocal effects seen amongst self-concept and achievement, research has shown the existence of a reciprocal relationship between attitude and achievement.

Interestingly related to attitudinal studies by researchers is the direct correlation between achievement and attitude (Lipnevich et al., 2011). Researchers have found a strong relationship between positive attitudes and beliefs towards mathematics and academic success in the mathematics (Ashcraft & Krause, 2007; Ma & Xu, 2004). The assumption following from such research is students with a negative attitude towards mathematics are low achievers while students with positive attitudes tend to be those individuals with high levels of achievement (Yilmaz et al., 2010). Bouhlila (2011), however, found some of the highest scoring countries had the greatest number of students with negative attitudes towards mathematics. With inconsistencies in research, both the positive and negative dispositions towards mathematics held by students, deserve the attention of researchers to gain a broader and fuller perspective of attitude and achievement.

Theory of Planned Behavior

Within a multi-variant study on achievement, Lipnevich et al. (2011) exposed the relationship between mathematical achievement and attitudes towards mathematics via Ajzen's theory of planned behavior. In essence, the implication of this theory is based on perception that a student is more apt to continue a noted attitude/behavior towards mathematics when others accept it. As a result, students with a negative attitude towards mathematics will continue to hold this negative disposition as long as it is socially accepted (i.e. by peers, teachers, parents), additionally implying that the disposition of students is malleable.

The results of the Lipenvich et al. (2011) study show a strong correlation between a student's mathematics attitude and achievement with a minimal difference in the mathematical attitudes across cultures. The strongest implication of this study is that the use of interventions designed to improve student attitudes have a direct impact on student achievement in mathematics. Rice et al. (2013) suggested that students who receive social support for math and science from teachers, peers and parents have better attitudes towards the subject and a better self-concept. However, Winheller, Hattie and Brown (2013) theorized too much interaction with teachers creates sense of being in trouble for the student and therefore creates a negative affect towards mathematics. This may be the reason why Lipenvich et al. (2011) noted that attitudes are the most important predictor for students' mathematical achievement coinciding with the value of social support in terms of intervention (Rice et al., 2013).

Individuals involved in the education of students should know which factors impact student attitude if there is interest in improving achievement in mathematics. An essential step is determining the attitude of the students to determine the necessary changes towards a positive disposition (Yilmaz et al., 2010). However, attitude determination is not the sole construct towards change. Literature is abundant in studies related to attitudes and middle school.

Changes in Students' Self-Concept of Ability in Mathematics During Middle School

Researchers have found a strong relationship between a student's positive attitude and belief towards mathematics and a student's mathematical success (Ashcraft & Krause, 2007; Ma & Xu, 2004). In fact, Wigfield and Karpathian (1991) noted the relation between self-concept, attitude, and achievement in mathematics as reciprocal by the middle school years. Significant to this finding is the corresponding decrease in self-concept of ability in mathematics, attitude towards math, and math achievement also recognized during this academic period.

The importance of attitudes and beliefs that appear in pre-adolescents is additionally highlighted by Riegle-Crumb, Moore, & Ramos-Wada (2011) with a specific focus on how differences in attitude and belief towards mathematics affect the future of students' career choices. Decisions and preferences students develop during adolescence are formative in future choices making awareness to these constructs important beyond middle school or even high school.

Expectancy-value Theory

It is expected that a student who has a strong self-concept of ability in mathematics will choose the pathway of mathematics through college and further pursue a STEM career. This is the basis of Eccles's expectancy-value of theory (Eccles & Wigfield, 1995). The alternative view is a student who has a weak or low self-concept of ability in mathematics will not pursue mathematics based on the personal characterization of having a lack of ability to be successful in mathematics. Whether or not a student's self-belief is true, the self-concept of ability in mathematics held by students is a key factor in a student's selection of math courses as well as future career options. This in itself supports future studies in the self-concept of students in the area of mathematics if there is concern with students' commitments to STEM fields.

Stage-environment Fit Approach

In a study completed by Watt (2004), students identified grade seven as a year of review and repetition in mathematics requiring less effort. Some may believe this is a reason for the decline in math achievement results as no other subjects appear to show negative effects based on this student belief according to Watt (2004). Coinciding with this perception by students that less effort is needed in seventh-grade, there was declined in students' math (Watt, 2004). Watt (2004) connected this decline to the stage-environment fit model.

According to the stage-environment fit approach (Eccles et al., 1993), academic outcomes decline after elementary school because middle schools fail to support students' developmental needs (Attard, 2013; Bicknell & Riley, 2012; Rice et al., 2013). This lack of fit between the middle school environment and the needs of the students then negatively impacts the middle school students' self-concepts, attitudes, and achievements. However, current research investigating young adolescents' self-concepts in middle grade settings is limited and generally focuses on the transitional period before and after middle school.

Middle school signifies a change from the elementary structure to that of the secondary school. Schools tend to be larger as do the class sizes. Teachers are dealing with a larger number of students on a daily basis, and the relationships tend to diverge. Changes in instructional modes, discipline and perceived supports also change for students. According to the work of Eccles et al. (1993), "developmentally inappropriate changes in a cluster of classroom organizational, instructional, and climate variables, including task structure, task complexity, grouping practices, evaluation techniques, motivational strategies, locus of responsibility for learning, and quality of teacher-student and student-student relationships contribute to negative changes seen in students' achievement-related beliefs" (p. 92) specifically as they transition to the middle school.

At the same time, students at this age are going through physical and psychological changes of their own suggesting a person-environment fit struggle. Similar to the approach suggested by stage-environment, Hunt (1975) suggested that the biological and psychological needs of a middle school student must be met in the classroom for self-beliefs to be positive. The amount of change at this age directly impacts the amount of attainment possible for a student in middle school (Watt, 2004). Future research could help to delineate the importance of age and transition in relation to a student's mathematical disposition towards mathematics and self-concept development.

Parker (2010) acknowledges how critical it is for middle school educators to be aware of young adolescents' perceptions of self. During this period of their lives, students move from describing themselves in physical and behavioral terms to incorporating more psychological aspects into their self-concept (Wigfield & Karpathian, 1991). The self-concept of the middle school student is said to be constantly fluctuating (Booth & Gerard, 2014). In fact, Booth and Gerard (2012) found that seventh-grade students enter middle school with the most positive feelings about their schools, however, they lose this feeling by the end of their academic year, demonstrating how a lack of fit model may not reveal itself immediately. The result is advocacy for systems to maintain middle school programs, which maintain models for evaluating and supporting students' self-concepts of ability. It is the classroom-learning environment that contributes to important student outcomes such as the positive enhancement of self-concept of ability and the creation of a stage-environment fit for middle school students (Lazarides & Watt, 2015).

With literature signifying dips in self-concept during the middle school years, the expectation is that fewer students will pursue mathematics during high school, college, and then further into career choices. Negative self-concepts, however, have the potential to be changed via classroom learning environmental changes such as teacher and/or classroom interventions (Lazarides & Watt, 2015). Cotton (1995) suggested effective school practices for enhancing the general self-concept of students, but little research has focused on teacher and classroom practices specific to self-concept of ability in mathematics.

Supporting the Development of Self-Concept

Identifying a student's attitude will not solve the problems seen in math achievement or self-concept. Supporting middle school students in mathematical achievement requires a focus on internal and external factors. The social-cognitive model of learning relies on the external social agents such as parents, teacher and friends. Social agents influence students' academic achievement directly through influencing elements such as self-concept of ability and attitude (Rice et al., 2013). Students who have the perception of social support from parents, teachers and peers tend to have more positive attitudes and self-concept of ability (Rice et al., 2013). As a result, parents, teachers, and peers are recognized as important social agents in establishing positive self-concept in the field of math education.

Peers

Peer emulation theory offers a theoretical basis for the relationship amongst peers and academic self-concept of ability and achievement. The peer emulation theory suggests interactions with peers, positive or negative, can affect a student's academic self-concept (Lee &

Shute, 2010). This includes the stereotype that math is for geeks, or not cool.

The work of Jones, Irvin, and Kibe (2012) relies on behavior. Differing from the peer emulation theory, their study states that the way in which friends interact affects academic self-concept. Research in this area extends this work, claiming that higher achieving friends might diminish academic self-concept. Although limited in examining other variables, such as the role of teachers or culture, the work of Jones et al. (2012) discusses the validity of academic supports such as peer relations to influence the development of self-concept in mathematics.

Parents

Parents' perceptions of their children's abilities and their expectations influence a child's development of self (Bleeker & Jacobs, 2004). In fact, research by Hergovich, Sirsch, and Felinger (2004) showed the existence of gender-dependent self-concepts. In this study, parents were shown to have more positive views of their sons' abilities in mathematics over their daughters' abilities in mathematics, despite the high achievement levels found in the girls.

Mothers who reported high perceptions of their children's abilities to succeed mathematically during middle school were significantly more likely to have adolescents who had high levels of self-concept though high school (Bleeker & Jacobs, 2004). A mother's belief about an adolescent's ability in mathematics is shaped by gender stereotypes that are related to the development of an adolescent's self-perceptions of ability in mathematics. Mothers who believe that boys are stronger than girls in mathematics indirectly impact the self-concept of ability of both genders despite the grades attained (Hergovich et al., 2004). These beliefs are based on the stereotypes held by the mothers, which are affected by culture, family beliefs, and upbringing. Such work suggests the importance of positive and unbiased supports to students in school, as they may not exist in the home environment. A closer examination about ways in which parents relay their beliefs about children's potential to achieve in math is needed in addition to factors beyond parental stereotypes that may impact a student's self-concept of ability.

These findings strengthen the gender-stereotypical differences from the transition to pre-adolescence to adolescence that is consistent with findings of other researchers. Such implications relate to understanding self-concept and achievement in research. Gender stereotyping is one of the factors limiting girls' positive self-concept about math learning. Successful social supports would diminish the gender differences relayed to students by parents.

Teachers

Literature strongly supports the power of a teacher to support development self-concepts of math ability in students. In an attempt to broaden the scope of previous studies on students' mathematical attitudes, Hassan et al. (2012) studied high school students' opinions on what factors influenced attitudes towards mathematics. Building on foundational theories, the authors take a different avenue of research by involving mathematically gifted Malaysian students in the process of the study, gathering students' perspectives in addition to observant data. Students who scored high in mathematics rated the materials used during teaching, textbooks, the workload and the teacher's attitude and personality as the leading factors in their success. Students who scored in the average range in mathematics rated the teacher's attitude and personality, teacher's knowledge on the topics, workload, and textbook use as the leading factors. Low-scoring students rated exams, grades, materials used during teaching, and the teacher's attitude as their leading factors.

The research of Hassan et al. (2012) added to research showing that the personality and attitude of a teacher are key factors in a high school student's mathematical disposition and overall sense of liking/disliking math. In fact, the earlier work of Wang et al. (2012) found that the in which “teachers deal with frustration and how they deal with mistakes may affect students’ self-concept of ability in mathematics and mathematics achievement” (p. 1234). Even earlier, Dweck (2006) took on the concept of how students handle mistakes to explain the development of growth versus fixed mindsets in students, adding validity to the work of Wang et al. (2012) and Hassan et al. (2012). The culmination of research supports the statement that the teacher is of vital importance in the development of a student’s self-concept.

Despite teacher assignment having a significant impact on the self-concept of students, teacher assignment does not predict student achievement (Wang et al., 2012). According to Goe and Stickler (2008), “many studies attest that some teachers contribute more to their students’ academic growth than other teachers, research has not been very successful at identifying the specific teacher qualifications, characteristics, and classroom practices that are most likely to improve student learning” (p. 1). Suggestions from Wang et al. (2012) as well as Goe and Stickler (2008), include the possible relation between a certified mathematics teacher and self-concept as well as self-concept and mathematics achievement. However, “with the exception of teachers’ experience during the first five years of teaching and teachers’ mathematics knowledge, researchers have not yet developed the tools, measures, and data sources that allow them to state, with a strong degree of certainty and consistency, which aspects of teacher quality matter most for student learning” (Goe & Stickler, p. 10, 2008). Further exploration into teacher qualifications, student self-concept of ability and student achievement in mathematics could provide pertinent information for understanding the connection between said constructs.

Teachers’ attitudes towards mathematics are additionally said to directly impact student attitudes towards mathematics and therefore indirectly impact students’ self-concept according to research done by Ma and Xu (2004). The latent class analyses of Kalder and Lesik (2011) found the characteristic of pre-service teachers may be related to positive attitudes and beliefs towards mathematics; making reference to the connection between a teacher's attitude and a student's attitude. Findings conclude that teachers with positive attitudes are those who are math majors, both elementary math majors and secondary math majors.

Di Martino and Zan (2010) posed the valuable question, "assuming both the possibility and the need of changing a student's attitude towards mathematics, how can the teacher act towards change?" (p. 45). Not having an answer to this question to this valuable question, a door has been opened for future research. Future researchers may consider how much of an impact elementary teachers, a teacher's level of experience or even a teacher's knowledge of mathematics has on a student's attitude towards mathematics, achievement in mathematics or self-concept of ability in mathematics. Until then research is needed that examines teacher and classroom changes that can be put into place immediately to support positive student self-concept development in the middle school.

Mathematics Learning Environment

Few researchers have considered the contextual effects associated with classrooms or schools that may be related to self-concept and achievement (Wilkins, 2004). Current literature suggests educators try to enhance self-concept and skill development simultaneously. According to the meta-analysis of the I/E frame of reference by Möller et al. (2009), mathematics achievement is higher when based on test scores instead of grades. Grades in turn have a stronger impact on self-concept. This emphasizes the need for teachers to use grades as a direct form of feedback for students and as a tool for supporting self-concept of ability.

Students with high levels of positive self-concept in mathematics are likely to use deep learning strategies. Differing from surface learning, such as rote memorization of concepts for temporary purposes (i.e. quizzes and tests), deep learning is the search for understanding, application, and relationships of mathematical content. Deep learners are recognized as having higher levels of achievement in mathematics, which is interceded by self-concept, as well as the inverse (McInerney et al., 2012). Students who use rote or surface level learning strategies are likely to have lower self-concepts about their ability to learn mathematics. The successful application of domain specific strategies as they relate to achievement indicates the enhancement of self-concept relies on the segregation of academic domains.

Students are inclined to have distinct self-concepts when it comes to subject domains. Implications of literature advise the separation and focus on the specific domains that are known to directly affect achievement because the correlation between self-concept and achievement is higher for related subjects over non-related subject. English achievement has a positive effect on self-concept of ability in English but a negative effect on self-concept of ability in mathematics (Chen, Hwang, Yeh, & Lin, 2012; McInerney et al., 2012). Math achievement has a positive effect on math achievement but has no effect on a student's English self-concept. A lack of reciprocity in domains, lends to the differentiation of mathematics from other domains when studying self-concept and achievement.

Self-concept Interventions

"Successful interventions are not limited to those conducted by researchers" (O'Mara et al., 2006, p. 199). Content, procedures, and evaluation of intervention programs need to be matched to the target domain of self-concept asking for the participation of all individuals involved (Arens et al., 2011). In fact, studies have shown that student-centered interventions are considered to be the strongest strategies in enhancing academic self-concept (Liem, Marsh, Martin, McInereney, & Yeung, 2013).

A tendency in mathematics education is to ignore weak achievement and for students to give up on mathematical achievement based on the idea that success in mathematics is a matter of inherent talent (National Mathematics Advisory Panel, 2008). Self-concept enhancement interventions, however, not only significantly boost self-concept but also have been found to be beneficial towards attitudes and achievement in mathematics (Pinxten et al., 2013; O'Mara, et al., 2006). However, successful interventions programs that focus on promoting students' academic self-concepts should also aim at developing their learning skills with an aim to bring about changes in their actual achievement. Academic self-concept enhancement should include skill development and not be singled out as a separate entity (Arens et al., 2011).

Effective interventions address students' self-concept and achievement. In accordance with the properties of both the self-enhancement and the reciprocal effects models, interventions targeted at enhancing students' self-concept have positive effects on both self-concept and achievement (Pinxten et al., 2013). According to the work of O'Mara et al. (2006), the long-term impact of interventions is likely to be stronger if both performance and self-concept are increased. If students' academic self-concepts are enhanced without improving academic achievement in mathematics then the gains in self-concept are likely to be short-lived (Green et al., 2006). Interventions additionally need to focus on specific dimensions of self-concept, i.e. mathematics self-concept instead of other specific and global components of self-concept (O'Mara et al., 2006). This leads to the need for educators to simultaneously enhance both mathematics self-concept and achievement to produce positive changes (Guay et al., 2003; Arens et al., 2011).

There is a need for more "intervention studies that are evaluated with a systematic profile of multidimensional self-concept scales in different domains to provide a more fine-grained tests of domain specificity of interventions on different self-concept domains" (O'Mara et al., 2006, p. 196). It seems timely for researchers and practitioners to utilize the knowledge of the relationships of self-concept, attitude, and achievement to create an array of student-centered interventions that include both direct and indirect methods to improve self-concept and achievement outcomes (O'Mara et al., 2006).

Conceptual Framework

Students are not born with a positive or negative disposition towards mathematics nor are they born with a positive or negative disposition of mathematics. It is the internal and external factors which students are exposed to, both inside and outside of the classroom, that form and develop the positive disposition of students. From the affective perspective, attitude and self-concept have been recognized as playing a significant role in this development. As a result of self-concept and attitude being key factors, the construct of mathematical achievement becomes part of the discussion. This is due to the reciprocity seen amongst the three constructs recognized by the time students reach middle school. The concern is that negative feelings and experiences pertaining to any of these factors lend themselves to the formation of a negative disposition towards learning mathematics.

According to the expectancy-value model the positive mathematical disposition of a student determines future achievement, interest in mathematics and career choice. Those students with a positive disposition are expected to be successful in mathematics, have a positive self-concept, and have a positive attitude towards mathematics venturing into STEM fields later in life. On the other side is the expectation of those students with a negative disposition towards mathematics, which is that they have more limited potential. These are the students with a negative attitude, a negative self-concept of ability, and lack in mathematical achievement.

Research shows these negative aspects peak during the transition to middle school. What is lacking in research is the determination of stage-environment fit that includes teacher and classroom interventions that can make a positive impact on students.

The social-constructivist lens of learning provides the foundation that a student's mathematical disposition is malleable. Furthermore, a student's self-concept of ability is defined as stable; however, it is not permanent (Bandura, 2006; Bong & Skaalvik, 2003; Di Martino and Zan, 2010; Marsh, Smith, Barnes, & Bustler, 1983). As students have different experiences in mathematics, their attitudes, self-concepts, and achievement can change. Guay, Larose, and Boivin (2004) suggested the need for researchers and practitioners to understand the psychological processes and classroom practices that mediate or moderate the academic self-concept-academic performance relationship. There is validity in studying self-concept development based on the expected reciprocity recognized amongst math achievement, self-concept, and attitude (Lazarides & Watt, 2015). Self-concept of ability is a learned construct leaving the door open for supporting and teaching positive self-concept development in the mathematics classroom.

This instrumental case study uses a qualitative and quantitative methodology to examine the self-concept of middle school students and self-concept interventions perceived by students to have an impact on their self-concept of ability in mathematics. As a middle school math teacher of 14 years, numerous students have made the statement "I can't do math." Many factors influence how students approach and look at the subject of mathematics and their abilities to achieve at the middle school level. As described by the social-constructivist lens, the perspective of students is the explanation of their unique math experiences. The perspective of students is the expression of their individual feelings. Educators must be open to students' perceptions to understand how the mathematical disposition of students is impacted by their self-concept of ability in mathematics and may be further impacted by classroom interventions.

The Marsh/Shavelson model provides a theoretical structure in understanding the academic and non-academic domains, the sub-areas of these domains and the further division of these facets of self-concept. This multidimensional aspect allows for the specific study of self-concept of ability in the academic domain of mathematics. The study of this specific domain allowed me to focus on mathematics as is pertains to self-concept in the middle school student, which is lacking in the field of education.

All individuals concerned with mathematics achievement will benefit from the results of this study with the greatest impact on those who directly work with students. By examining student perception, this case study examines the mathematical self-concepts of students based on the concepts and theories described. How do middle school students describe their self-concept of ability in mathematics? What teacher/classroom interventions are recognized by students as having an impact on their self-concept of ability? Through the perspective of the student, insight into these questions may be addressed to fill the gap in mathematics research with the intent of making a positive impact on attitude, self-concept, achievement. Ultimately the intent is to direct positive changes in the negative mathematical dispositions of students and interest in the mathematical domain of STEM fields.

To make a positive impact on mathematics achievement in middle school students, reformers should begin with listening to the voices of students and making changes at the classroom level that make a positive impact on the negative mathematical dispositions of students. The educational arena needs to focus not only on mathematical skills but also on the self-concept of students if improvements are expected in middle school achievement.

Conclusion

There exists both cognitive and biological principles that influence students dislike of school (Willingham, 2009). Accordingly, the mathematical achievement and learning of middle school students are impacted by these principles throughout their mathematical learning experience. Willingham (2009) provided guiding principles to help teachers in planning but failed to describe the implications such principles may have on the attitude, self-concept, and achievement of the middle school student.

The review of current literature supports the interdependence of attitude, achievement, and self-concept. Few studies examine the impact of support and interventions on self-concept of ability from the perspective of the student. Essentially, the literature fails to discuss collaborative efforts and the potential impacts such efforts could have on a student's sense of self-concept.

The encouragement of more positive self-concept as a part of classroom practices is more effective for students when teachers use separate interventions (Marsh et al., 2005). There is little work expressing ways to implement different interventions, The differences in self-concept rely on various factors, however, there is little research to be found that clarifies what teacher/classroom interventions can be put into place to promote a positive impact on students' self-concept in mathematics (Hergovich et al., 2004). A specific focus on the hierarchical or causal role in which social supports play in the development of a middle school student's self-concept of ability in mathematics is suggested.

The general consensus within literature shows a reciprocal effects' decrease in self-concept as students' progress in grade levels. Research indicates the decreases in students' self-concept continue to be a concern throughout secondary school with negativity towards mathematics more prominent during the middles school years. Reasons for the decreases in self-concept and and negativity include a lack of social supports, gender differences, classroom environment, and stereotypical views as some of the dominating factors. Few studies, however, have specifically examined middle school students' self-concept of ability in mathematics as its own domain.

With the notion of potential interventions available, one would expect clarity in literature pertaining to the identified supports. This is not the case. There is little indication of what interventions have been deemed successful determinants for middle school-aged students worldwide. It is possible that successful interventions have not been identified due to the inadequacy in methodologies being used to measure growth (O'Mara et al., 2006). This observation suggests that the inclusion of student voice is a tool to gain perspectives on interventions that may be successful in addressing the critical issue of low math achievement, self-concept and attitude seen in the middle school students.

CHAPTER 3

METHODOLOGY

This mixed methods case study examines eighth-grade middle school students' perception of their self-concept of ability in mathematics and documents teacher/classroom interventions identified by middle school students as having an impact on the development of their positive mathematical disposition. Studies have shown the reciprocal effects of self-concept of ability, a student's attitude, and achievement in mathematics. Research additionally suggests that specific instructional interventions can improve students' self-concepts and furthermore, their attitudes and achievement. Literature, however, lacks specific interventions deemed to have a positive impact on students' self-concept of ability in mathematics. According to Attard (2013), there are few studies in mathematics that incorporate student voice with the intent of improving mathematical classroom practices. More specifically, the use of student voice lacks the documentation of teacher/classroom interventions that can be used to support the development of students' positive self-concept of ability in mathematics.

This instrumental case study allowed for an understanding of the self-concept of ability in middle school students and the documentation of interventions believed to have an impact on students' self-concept in math, all through the perspective of the student. The quantitative aspects of the online survey (see Appendix A for the online survey questions) allowed for a quantifying glimpse into the self-concept of students, however, to truly gain an in-depth view into the student, their beliefs and affect it was essential to move beyond the scope of qualitative research into a methodology and design that allowed students to share their mathematical experience and stories. Bromely (as cited in Merriam, 2009) wrote that case studies such as this “get as close to the subject of interest as they possibly can” (p. 46) widening the perspective into student thoughts, feelings, and desires. With this design, students’ voices can influence instruction and middle school math classrooms can be changed to include self-concept interventions that the students themselves have voiced as vital to their mathematical success.

The mixed methods approach allowed for the use of both qualitative and quantitative data to access rich data in telling the story of self-concept in mathematics from the perspective of middle school students. The quantitative aspect, included within participant surveys, allowed for the description of students’ self-concept of ability in mathematics via Likert-scale measures. With an understanding that quantitative questions alone cannot create a clear, descriptive picture of feelings, the same survey allowed for the collection of qualitative open-ended perceptual data. In conjunction with qualitative interviews, the perceptual reflections collected created a rich pool of data from the perspective of the student. The result was the provision of a mixed methods approach to research that explored “the real-life contemporary bounded system over time through multiple sources of information” (Creswell, 2013, p. 97) that preserved the perspective of the student.

The study used a phenomenological approach. This case study is a provision for an analysis of middle school math students’ self-concepts and documentation of interventions identified by students as influencing their self-concept of ability in math. The results add to current literature on the development of a student’s positive mathematical disposition by providing insight into the students’ perceptions of what helps them to feel successful and keeps them striving for success in mathematics. The results also are a provision of student-identified interventions that can be used in the math classroom with the intent of making a positive impact on the mathematical disposition of students. With the understanding that a student’s self-concept is malleable, the results of this research, in conjunction with the social-constructivist lens, provide a holistic picture in understanding the self-concept of middle school students as it relates to their positive mathematical disposition and the value classroom/teacher practices have on the development of students.

The chapter describes the mixed methods research design and methodology. As a result, the discussions within the chapter include a rationale for combining both qualitative and quantitative data within the case study design. The setting as well as the selection of participants to support transferability and representative samplings is also discussed within Chapter 3. An overview of the research design provides insight into the steps that were followed in the research process. Potential limitations are posed prior to the summary, which shares the validity, credibility and transferability to found in this preliminary research.

Setting

The setting for the study is a public middle school consisting of approximately 400 seventh- and eighth-grade students. Approximately 95% percent of the students from the school are Caucasian, 4% percent Asian, 1.4% Hispanic and 0.7% Black where approximately 53% of the student population is male and 46% female. In terms of the socioeconomic background, approximately 95% of the students are ineligible for free/reduced lunch, 2% for reduced lunch, and 3% for free lunch. The factors of race/ethnicity, and socioeconomic background were not used to define groups or samplings of participants to narrow the scope of the study.

The eighth-grade mathematics curriculum at the setting consists of heterogeneously grouped algebra and pre-algebra courses with some students accessing individualized curriculums. Students are separated into two teams with each team consisting of two algebra classes and three pre-algebra that are aligned to the common core curriculum. Math classes are approximately 70 minutes in length and taught by a team-assigned math teacher, with the exception of individualized programs. Blocks of math classes meet on a rotating schedule throughout the week varying the times of classes and days of the week on which classes meet. On average students have math class three times a week with the exception of the individualized programs, which meet daily for approximately 45 minutes each session.

The middle school chosen for the study is a cooperative school consisting of grades seven and eight. Seventh grade at the middle school consists of students who transition from two distinct school districts to form a combined cooperative school. According to researchers Bicknell and Riley (2012) “systemic changes affect virtually all students in some way; they provide different challenges and interrupt continuities in a student’s life” (p. 2). Literature reports academic achievement and self-perceptions drops immediately after students transition to middle school (Eccles, Wigfield, Flanagan, Miller, Reuman, & Yee, 1989; Fink, 2010; Rockoff & Lockwood, 2010; Seidman, Allen, Aber, Mitchell, & Feinman, 1994; Zanobini & Usai, 2002). More specifically, seventh-grade students have been shown to drop in math achievement during the transition to middle school (Schwerdt & West, 2013). However, Parker (2010) reported that middle school students initially show positive shifts in self-concept. With literature abundant on the negative impact transition can have on the self-concept and achievement of seventh grade students, seventh-grade students were not utilized for this study.

The bounding aspects of study are a purposeful sampling of eighth-graders within the middle school during the 2015-2016 school year. Choosing eighth-grade students for the sampling does not negate the importance of transition and the impact it may have on middle school math achievement but instead decreases transition as a focal point and its implications on self-concept at this time. Parker (2010) proposed that despite the positive shift in self-concept recognized during the initial transition to middle school "the subsequent declines as a student moves through the middle grades are cause for concern and must be explored through future research" (Parker, 2010, p. 10).

The understanding that the self-concept of middle school students is a significant factor impacting the mathematical success of students and the abundance of research signifying the decrease in students' mathematical dispositions towards math during the middle school years led to the following research questions:

- How do middle school students describe their self-concept of ability in math?
- What teacher/classroom interventions are recognized by students as having an impact on their self-concept of ability?

In conjunction with a social-constructivist lens, the mixed methods approach was used to examine middle school students' perspectives and their insight into what interventions impact self-concept of ability in mathematics. With the complexity of external variables (i.e. gender, age, parent support, socio-economic) impacting the middle school student's positive disposition, attitude, self-concept and academic achievement, this case study focused on the role of classroom/teacher interventions on the development of a positive self-concept of ability. With the delamination of specific factors, a holistic design helped to encompass the perception of the student without the distractors of additional outside factors. The focus turned from the impeding variables that cannot be easily separated from the case, to the research questions and their relationship to the end product.

Participants

A purposeful sampling was utilized to select what Bloomberg and Volpe (2012) refer to as "information rich cases" to gain an understanding of interventions have an impact on the middle school math student. For this study, all students accessing the math curriculum were considered for participation based on team placement. Those students, who had access to the researcher as a math teacher, were not considered for participation.

Ten heterogeneously grouped eighth-grade middle school students were studied "to provide ample opportunity to identify themes of the cases as well as conduct cross-case theme analysis" (Creswell, 2013, p. 157). The research participants were selected using a maximum variation strategy to represent diverse cases and display multiple student perspectives (Bloomberg & Volpe, 2012; Creswell, 2013).

Math teacher volunteers were asked to nominate eighth-grade students. Teachers were then asked to nominate those students have had experiences, both positive and negative, with routine feedback and reinforcement regarding their learning progress, high expectations for learning, positive interactions between with the math teacher, instructional groups that are formed in the classroom to fit the students' academic and affective needs, as well as extra time and help needed due to a risk of school failure (Cotton, 1995). The intent of the targeted efforts via the teacher nomination was to organize a representative sampling of qualified participants that maximize the differences at the beginning of the study.

From the teacher nominations, 12 students with extreme experiences, as well as variances in classroom courses and gender were invited to participate in the study. The intent of this maximum variation sampling was to increase the likelihood that the findings would reflect the diverse student perspectives of self-concept of ability in mathematics and the interventions that had an impact on their mathematical dispositions (Creswell, 2013). With the assumption that the sampling of students was representative of the student population, the transferability of the case study is increased.

Each research participant completed informed consent/assent form (see Appendix B for the informed consent/assent for participation in research) to participate in the study. Parents and guardians of the purposeful sampling were mailed consent letters to explain the study and invite their child to participate. Based on received consent forms, the sampling of participants met one-on-one with the primary investigator. The study and the research steps were explained to each participant.

Data

The research questions inform the data collection methods. Demographic, contextual, and perceptual data were gathered through interviews and a mixed methods survey to provide for a vigorous case study (Merriam, 2009).

Online Survey

Student online surveys were administered to research participants as an opportunity to not only describe their self-concept of ability in mathematics but to also allow participants to provide insight into interventions that had an impact of their self-concept in mathematics.

The Academic Self-Description Questionnaire II (ASDQ II) is an existing multidimensional self-concept instrument developed for use with pre-adolescent children (see Appendix D for the full Academic Self-Description Questionnaire II). The ASDQII is a series of age-based questions used to measure multiple dimensions of academic self-concept, as well as the single dimension of general school self-concept (see Marsh, 1990; Marsh 1992; Byrne 1996). The ASDQII contains 17 scales; nine core subject (English, literature, foreign languages, history, geography, commerce, computer studies, science, and mathematics), six non-core subject (physical education, industrial arts, art, music, religious studies, and health), one physical (physical) and one general school subscale. Despite the ability to provide the perspective of students in an easily managed qualitative format, the ASDQII measures additional domains not necessary for this study. The ASDQII also does not include open-ended responses and therefore decreases the personalization, which can be gained through qualitative methodologies. However, the ASDQII, in conjunction with qualitative methodologies, provides supportive evidence through the multi-dimensional perspective of self-concept as defined by the Marsh/Shavelson model (Bloomberg & Volpe, 2012). For this reason the questionnaire components which support the definition of a student's self-concept of ability in mathematics were used in their original structure and embedded within the survey to provide a mixed methods approach.

Students were additionally asked quantitative questions pertaining to self-concept interventions. Questions were aligned to Cotton's (1995) effective school practices deemed to be supportive of self-concept development. Although not directly related to self-concept of ability in mathematics the intent was to gain the students' perspectives as to the effectiveness of such practices in their mathematics classroom.

The use of such a free-response method is not typically used in self-concept research but can be found in various online surveys. Like journal writing and the writing of one's life history, responding in a written format enhances the research participant's reflective and in-depth response in a seemingly less obtrusive manner (Bloomberg & Volpe, 2012). Unlike interviews, writing allows for revision and sets the stage for deeper, reflective thinking. In essence, the open-ended qualitative nature of the written responses provided an avenue into the experiences and self-concept of research participants; their individual realities.

Semi-structured Student Interviews

To support the study, semi-structured research participant interviews followed the completion of the online survey. Interviews consisted of a combination of guiding interview questions aligned to research questions (see Appendix C for the semi-structured student interview instrument) and structured demographic questions. The goal of interviewing participants, however, was to stimulate in-depth, content-rich personal accounts, and perspectives of students' self-concept of ability in mathematics and the interventions they felt had an impact on their self-concept (Bloomberg & Volpe, 2012).

An interview is a credible methodology in qualitative research. In this case study, interviews facilitated the understanding of students' self-concept of ability in mathematics The data collected through interviews tells the story of what the student believes and feels to be true; a social-constructivist provision of what students identify as fact (Bloomberg & Volpe, 2012). Given that the researcher actively interacted with the participants and the research participants cooperated, articulated their thoughts and openly shared their perspectives, the information collected via the interview is considered valid data (Bloomberg & Volpe, 2012).

Analysis

Case study research involves a detailed description of the case, followed by an analysis of the data for themes, patterns of issues (Bloomberg & Volpe, 2012, p. 136). Data collection and analysis were ongoing actions in research requiring full immersion, review, and exploration. This case study used a blend of template and editing approaches as suggested by Bloomberg and Volpe (2012) to adopt a flexible and open analysis methodology.

Online Survey

Questions utilized from the ASDQII use an 8-point Likert-scale with the following labels: definitely false (1), false (2), mostly false (3), more false than true (4), more true than false (5), mostly true (6), true (7), and definitely true (8). Similar in structure, questions relating to the interventions use a 6-point Likert-scale with the following labels: definitely negative (1), mostly negative (2), mostly positive (3), definitely positive (4), I have never experienced this (5). Statistical tests of significance, using SPSS software, provided a quantitative description of students' self-concept.

Interviews and Written Responses

The interviews and written responses required review to develop an overall sense of the student's experience, provide in-depth knowledge of how students describe their self-concept of ability in math and the interventions recognized by students as having an impact on their self-concept of ability (Hein and Austin, 2001). Interviews were recorded and transcribed verbatim. A second party transcriptionist was not used which allowed the researcher further immersion into the data as each interview was transcribed. (Bloomberg & Volpe, 2012). The transcriptions, in conjunction with student written responses, were read and reread to identify the big ideas, uncover themes, and develop categories as well as "descriptions to arrive at the essence of the experiences" (Creswell, 2013, p. 236).

The descriptors for each category were developed via an open coding scheme using NVivo software where participant language was used as labels. The use of open coding allowed for inductive analysis and relinquished the forcing of data into a pre-defined category. Bloomberg and Volpe (2012) recommended categories be aligned to research questions, as these categories will become the analytical categories needed for analysis and the mainstay of the study.

As each written response and transcription was read, sorted, and coded, summary notes were used to create a profile for each research participant. Data summary tables, one for each category, were used to store participant pseudonyms and descriptors in a matrix formation. The use of a matrix allowed for the identification of categories based on the work of 1) the number of people or frequency which something arises, 2) categories which appear credible, 3) uniqueness in data and 4) under-recognized categories (Guba and Lincolns as seen in Merriam, 2009). The use of a matrix additionally allowed for reflection and identification of themes necessary in summarizing. Tallies and frequencies from the data summary tables were used to record the responses of the research participants and support cross-analysis of the case.

Bloomberg and Volpe (2012) suggested writing memos and/or journaling in conjunction with reading, sorting, coding and summarizing data. As a result, these notes were used to inform a coding scheme, a coding scheme chart, an interpretation outline, an analytic category tool, and a consistency chart of findings, interpretations and conclusions (Bloomberg & Volpe, 2012). The use of these supplemental tools adds validity to the research study.

This combination of methodologies allowed for the triangulation of data, however, member checking added to the credibility to the study findings. For this reason, interview transcripts were offered to participants for review. Table 1 shows the approximate time frame of data collection and analysis for the study.

Table 1

Overview of Data Collection and Analysis Time Frame

	Nov. 2015	**Dec. 2015**	**Jan. 2016**	**Feb. 2016**	**Mar. 2016**
Surveys	Share Link	Code/Analyze Qualitative data (SPSS)	Compile data in matrix	Data review	Complete analysis
Interviews	Pilot interview questions and revise	Interview as surveys completed	Member Checks	Code & analyze	Complete analysis

Participant Rights

Within data collection and analysis, it is the researcher's responsibility to protect the anonymity of the informants. As data was collected on individuals, names were removed along with identifying data and replaced with Participant 1, Participant 2, etc. to sustain anonymity. This manner of labeling is also used throughout the dissertation and is not connected the participant names or identifying data. Participant names and identifying data were coded for the use of the researcher only. Valuable comments or survey sentences are used to illustrate findings, but to protect the identities of participants and sustain levels of confidentially, the research is based on the culmination of data and not reports on specific individuals.

There were no known risks related to participating in this case study, and participation was based on volunteerism as well as consent. Institutional review board protocols, and rules for research with children were strictly followed including the requirement of clearly written informed consent forms signed by student parents/guardians. Upon parent/guardian consent, the study and role of the student were explained to individual student participants. Participants were allowed to opt out of the study at any time for any reason and in such a case, were not included in the study. Participants were reminded that there are no right or wrong answers. The expectation, shared with participants, was honesty in return for confidentiality; participant writings will remain anonymous and will not be shared with any other individuals. The intent is to provide in-depth knowledge to those in the arena of math education via a report of multiple student perspectives where general information is provided to convey a "composite picture rather than an individual picture" (Creswell, 2013, p. 175).

Potential Limitations

The choice of one case school and a small sampling for qualitative data are potential limitations to this case study. A case study that focuses on a single unit impacts generalizability and limits the amount of information needed for an in-depth picture (Merriam, 2009). Creswell (2013) claimed a case "study of more than one case dilutes the overall analysis; the more cases an individual studies the less the depth in any case" (p. 103). The question then becomes how many cases to study. The motivation for a larger number of cases, beyond the 4 to 5 proposed by Creswell is the idea of generalizability and maximum variation, which is not the expectation of qualitative research. Erikson (1986) asserted that what is learned from one case can be transferred to other similar situations and should not be void (as cited in Merriam, 2009, p. 51). This perspective supported the intentions of the qualitative focus of this study allowing for this preliminary research to be used its own purposes as well as to provide background for future studies and/or as an application in similar settings.

Insider research can be risky. According to Creswell (2013), studying one's own workplace, as in this case, "raises questions about whether good data can be collected and sorted" (p. 151). Data collection can also introduce a power imbalance between the researcher and the participants being studied. For this reason, multiple strategies of validation were used for accuracy and insightfulness in addition to a specific attentiveness to confidentiality, sensitivity and organizational politics (Creswell, 2013; Coghlan & Brannick, 2014).

Validation supported the challenges and limitations of being a researcher within a personal work setting. All information gained will remain anonymous and related to the research at hand as well as the separation of roles as teacher and researcher. Personal knowledge was void from the analysis if it were not collected during the data collection process. Member checking was used as a validation strategy within the process to support the triangulation and validation (Creswell, 2013).

Researcher bias due to the dual relationship of teacher-researcher was recognized as a potential limitation in research. To completely detach one's self from a study is nearly impossible and according to qualitative research methods standards, not necessary. In fact, insider research allowed for the use of pre-understandings for personal and professional development while simultaneously working on practical issues (Coghlan & Brannick, 2014).

Clarifying points and transparency with regards to research work amongst school personnel is important throughout the research. Although essential to keep the positive relationships with those who may be most helpful in the research process, ethical guidelines must remain in the forefront. Coghlan and Brannick (2014) referred to this as "not deceiving or doing harm, and being true to the research process" by being authentic, reasonable, and responsible (p. 160).

By surfacing potential limitations and being mindful of bias, the intent was to minimize any ethical or political impact on the study while keeping the passion for the work itself alive. "Separating your research from other aspects of your life cuts you off from a major source of insights, hypotheses, and validity checks" (Maxwell, 2005, p. 38). There is great value in bringing forth pre-understandings to research. However, it is just as important to create new understandings drawn from the experience (Coghlan & Brannick, 2014).

Pilot Study

A small pilot study was conducted to test the proposed interview questions. Students, who were possible participants for the final study, were asked to in participate in pilot interviews. Based on the pilot study, interview questions were revised for direction and clarity while other questions were removed with the intent of avoiding repetition or redundancy. The pilot study allowed for practice rounds of teacher-student interviewing and further allowed clear, and concise interview questions that allowed for openness and honesty in student responses.

Conclusion

The methodology selected for this study was chosen purposely and intentionally. Beyond the scope of demographic data, student perceptions, perspectives and context-rich personal accounts of middle school students were necessary to address the research questions (Bloomberg & Volpe, 2012). Significant in this combination of methods chosen was the careful selection of an approach that allowed for student voice that was both accurate and a true representation of the middle school math student.

The validity in the chosen mixed methodology comes from the phenomenological view. Through student interviews, written responses and survey questions, the middle school students who participated in this study shared their mathematical experiences from the their point of view. The accuracy of this data, however, resulted from “interviewing as a relationship” (Seidman, 2013, p. 97). The dual role of being a teacher-researcher supported the crafting of successful interviewing relationships with the participants. Years of experience working as a middle school teacher proved to be advantageous in developing a rapport with participants. To hear the voice of the middle school students, it was essential to craft relationships quickly with participants that were based on openness, trust, and honesty.

Insider research was the ideal methodology for this kind of study. Participants were easily accessible from the sampling choice to invite for interviews. Interviewing relationships were quickly and effectively developed. Subjective understandings of student understandings were accessed via open, trusting and honest interviews and accurate data was collected to share with stakeholders directly vested in the positive mathematical disposition of middle school math students. To understand the challenge of identifying universals in the study of humans, especially ever-changing middle school students, the context-knowledge gained from this mixed methods research remains valuable in its transferability and credibility.

CHAPTER 4

RESULTS

The purpose of this case study was to examine students' self-concept of ability as it relates to the positive mathematical disposition of middle school students' achievement in mathematics. In this chapter, results are presented to support the study's research questions (1) how do middle school students describe their self-concept of ability in math? and (2) what teacher/classroom interventions are recognized by students as having an impact on their self-concept of ability?

This chapter provides the method of analysis, a presentation of results and a summary. An explanation is included as to how data was interpreted, organized, and coded. The results are presented with supporting tables in conjunction with suggestions about why the results may be as such and accounts for discrepancies in the data. The chapter concludes with a summary of the results linked to the purpose of the study, and the problem statement.

Analysis Method

The primary data source for this case study consisted of participant interviews. Prior to completing an individual interview, participants completed an online survey to allow participants' describe their self-concept of abilities in mathematics using a Likert scale. Open-ended prompts were available to participants to provide written details regarding their self-concept of ability in mathematics. As surveys were completed, qualitative data was collected within SPSS. Quantitative data from surveys was collected into NVivo to be coded along with interview data.

In the analysis of the self-concept of participants and their perspectives on interventions, the quantitative data gathered from the online survey brought up the need to discern about and debate the merits of how to treat the Likert scale data. According to Laerd (2013), a

> Likert scale that contains five values - strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree - is ordinal. However, where a Likert scale contains seven or more value - strongly agree, moderately agree, agree, neither agree nor disagree, disagree, moderately disagree, and strongly disagree - the underlying scale is sometimes treated as continuous (although where you should do this is a cause of great dispute). (p. 1)

The initial seven questions of the survey pertained to the self-concept of ability in mathematics from the ASDQII. The responses to these questions provided a tool for participants to describe their self-concept of ability in mathematics via an 8-point Likert scale (1= “Definitely False,” 2 = “False,” 3 = “Mostly False,” 4 = “More False than True,” 5 = “More True than False”, 6 = “Mostly True”, 7 = “True” or 8 = “Definitely True”) Based on the work presented by Laerd Statistics (2013) Likert scale data can be treated as continuous. According to Creswell (2013), to treat Likert scale data on an interval scale researchers should determine if the distance between each value on the scale is equal and if this cannot be done then the data should be treated as ordinal data (p. 167). In the case of the Likert scale used for the participant online survey, the distance between each value could not be proven to be equal, thus the data was determined to be ordinal.

The significance of this determination of data being ordinal was valuable in establishing the manner in which the metrics were reported. For this reason, the measure of central tendency used was the median along with displays of range and the interquartile range rather than continuous statistical representations of mean, and standard deviations.

After each interview, recordings were transcribed by the researcher and then compared to the original audio recordings for accuracy. After multiple readings of interview transcripts, transcripts were coded along with qualitative data from surveys using NVivo software. First cycle coding began with an elemental method, In Vivo coding, as suggested by Saldaña (2016) when coding interviews to capture the participant's voice.

For the purpose of this study, attitude was defined as an individual's feelings *towards* a subject, in this case mathematics, which encompasses the affective domain. Due to its description as an affective coding method based on values, attitude, and beliefs, value coding was applied to the qualitative data. It is this coding method that allowed the data to be specifically coded in alignment with the of the study questions as the constructs of attitude, value and belief were directly related to self-concept and positive disposition in math students. Saldaña (2016) described the significance of affective coding methods as modes of investigating "the core motives for human action, reaction and interaction" (p. 124) which further correlated to the purpose and goals of the study.

Following the first cycle coding, focused coding was applied to categorize the data based on similarities and thematic patterns. As shown in Table 2, the grouping of categories supported the development of major themes and sub-themes to examine students' self-concept of ability as it relates to the positive mathematical disposition of middle school students' achievement in mathematics.

Table 2

Major Themes and Sub-Themes

Major Themes	Sub-Themes
Self-concept of Ability	
Multidimensionality of Attitude	Vision of mathematics Self-perceived competence
Significance of grades	
Academic press	High-Expectations Perseverance Equity
Feedback and Reinforcement	
Social Support	Teacher-student interaction Peer-peer interaction Instructional groups
Modifying the Learning Environment	Relevance Learning styles

Presentation of Findings

Approximately 100 eighth-grade students were considered for the study. A total of 25 eighth-grade students were nominated for this study who experienced routine feedback and reinforcement regarding their learning progress, high expectations, positive interactions with a math teacher, and/or instructional groups formed in the classroom to fit the their academic and affective needs. Of the 25 nominations, two individuals were eliminated due to family connections outside of school therefore helping to eliminate any personal bias related. A total of 23 individuals were invited to participate in the study of which 12 presented parental consent and student assent forms between January 15, 2016 through January 24, 2016. Data collection began via individual participant surveys scheduled between January 25, 2016 and February 8, 2016. After successful completion of the individual survey, two participants opted out of the study. The resulting final sample size for the study resulted in 10 participants.

All participants were active and current eighth-grade math students ranging in math course enrollment and class level assignment. As shown in Table 3, Participants ranged in age from 13-14 with 50% of participants being male and 50% being female. Participant access to math education ranged from regular education (60%), special education (20%) to 504 educational plans (20%). Identification of students with an Individual Educational Plan or 504 Plan were removed for participant privacy and protection.

Table 3

Summary of Participant Demographics

		Age		Math Course		
		13	14	Algebra	8th Grade Math	Total
Gender	Female	2	3	2	3	5
	Male	0	5	2	3	5
Total		2	8	4	6	10

Note. (N = 10)

Self-Concept of Ability

The intent of this study was not to compare achievement, attitude or the self-concept of mathematics to other subjects. Differing from the initial purpose of the I/E model, which was developed to compare mathematics and English, this study took into consideration the multidimensionality of academic self-concept and focused explicitly on self-concept of ability in mathematics (Pinxten et al., 2013, p. 159). This particular expansion allowed for a specific focus in the area of mathematics and the positive mathematical disposition of middle school students while utilizing the voice of students as a key tool in accessing valuable data.

To measure students' self-concept of ability in mathematics, participants participated in an online survey using a Likert scale to consider their satisfaction with their performance in math, how quickly they learned things in math, the ease of learning math concepts, the importance of doing well in math, their grades in math, how well they did in comparison to their peers and their previous performance in math. When the quantitative data was examined, the median response for each aspect of the self-concept of ability was calculated. Most participants indicated "Mostly True" when asked "I am satisfied with how well I do in math classes" and "I get good marks in math classes" (Mdn=6, IQR=3). Most participants indicated "More True than False" when responding to "I learn things quickly in math classes" (Mdn=5, IQR=2) and when responding to "Compared to others my age I am good at math classes" (Mdn=5, IQR=3)". Most participants indicated "Mostly True" when responding to "It is important for me to do well in math classes" (Mdn=7, IQR=2). Most participants indicated, "More False than True" when responding to "I have always done well in math classes" (Mdn=4, IQR=4). When responding to "Work in math classes is easy for me" most participants responded within the range "More True than False" and "Mostly True" (Mdn=5.5, IQR=2).

Table 4

Median Response Describing Self-Concept of Ability in Mathematics

		Self-Concept of Ability in Mathematics						
		I am satisfied with how well I do in math	I learn things quickly in math	It is important for me to do well in math	I get good marks in math	Work in math classes is easy for me	Compared to others my age I am good at math	I have always done well in math
N	Valid	10	10	10	10	10	10	10
	Missing	0	0	0	0	0	0	0
Median		6.00	5.00	7.00	6.00	5.50	5.00	4.00

The responses from the participants (N = 10) were divided into positive and negative to analyze the overall feeling of participants' self-concept of ability in mathematics. Likert scaled responses of 1= "Definitely False", 2 = "False", 3 = "Mostly False", or 4 = "More False than True" represent a negative self-concept. Likert scaled responses of 5 = "More True than False", 6 = "Mostly True", 7 = "True" or 8 = "Definitely True" represented a positive self-concept. The analysis of the median responses describing self-concept of ability in Table 5 present an overall positive self-concept of ability in mathematics with a lower median for "I have always done well in math."

Table 5

Summary of Positive and Negative Self-Concept of Ability in Mathematics

		Self-Concept of Ability in Mathematics	
		Positive Response	Negative Response
Self-Concept of Ability in Mathematics	I am satisfied with how well I do in math	80%	20%
	I learn things quickly in math	60%	40%
	It is important for me to do well in math	100%	0%
	I get good marks in math	80%	20%
	Work in math classes is easy for me	70%	30%
	Compared to others my age I am good at math	60%	40%
	I have always done well in math	30%	70%

Participants tend to have a positive self-concept as it pertains to "I am satisfied with how well I do in math classes" (80%), "I get good marks in math classes" (80%), and "It is important for me to do well in math classes" (100%). "I learn things quickly in math class" (60%) and

"Compared to others my age I am good at math classes" (60%) leaned towards a positive for participants and showed the smallest variance of percentage (20%). Most participants (70%) responded negatively to "I have always done well in math classes."

The findings suggest participants have an overall positive self-concept of ability in mathematics. However, despite a positive self-concept of ability in mathematics, not all students had a history of doing well in mathematics. Based on the expectancy-value model, prior achievement is a predictor future achievement. The data presented here does not align with this model, which suggests that the self-concept of students may change over time.

Multidimensionality of Attitude

Participants' "inclination to have particular attitudes, beliefs, feelings, emotions, moods or temperaments with respect to mathematics" (Beyers, 2011, p. 71) varied in the study. All participants shared a combination of values, beliefs, and emotions related to mathematics helping to understand their mathematical disposition towards mathematics.

- "Math might be one of my second favorite blocks. I like it. It is good."
- "I don't think I every really disliked it."
- "Math is a great subject."
- "Fun. Fantastic. Love math."
- "Intriguing."
- Others shared their dislike for the subject with comments such as:
- "Math has been not so good. I just don't like it."
- "I'm not very good at it and I don't like it. I don't really care about math."
- "Not my favorite subject and not my best subject. Never has been."
- "Go back to your planet and forget you ever [inaudible] on this planet."

The result was a mix of what researchers would describe as both positive and negative attitudes towards math. While some participants were very clear in comments in regards to their liking or dislike of mathematics, there were participants who were not definite on their attitudes. One participant in particular saw the aggregated liking or disliking of mathematics as “a half and half balance” where “there is a lot of times where I like math because I get it…. then there is also times where I completely dislike it because when I usually don't like math I will come up with something like what does this have to do with real-world stuff.”

According to Booth and Gerard (2012), the self-concept of the middle school student is constantly fluctuating. In fact, Booth and Gerard (2012) found that while seventh-grade students enter middle school with the most positive feelings about their school, they lose this feeling by the end of their academic year. With the reciprocal effects amongst self-concept, attitude, and achievement expected to be true, it may be the case that a fluctuation in self-concept causes a fluctuation in attitude that does not reveal itself immediately.

Vision of Mathematics

According the Ontario Principal’s Council (2008), “the vision of mathematics today includes beliefs that students should learn to value mathematics” (p. 4) When asked to reflect upon the pros of mathematics, to describe mathematics or to share pros and cons of mathematics, participants shared a common theme of seeing value in learning mathematics.

- Math “applies to everything.”
- “I guess like how the world works. It is like science and it relates to everything I guess.”
- “It goes into everything; it helps you with life and your jobs. It goes into every job.”

- Math is "Really, really important. Your understanding of math and the concepts of math lead into just about anything else you do and that if there is one thing that you absolutely had to specialize in that would branch into anything else that would be math."
- "This stuff is going to help you a lot later in life. It is going to take you very far."
- "I think that you need to learn those things just for the future."
- "Math. I have to do because I have to succeed in life and I need math to succeed."
- "It is not just one tiny part it is a big part of your life that you need to have."
- "It can get you extremely far in whatever you do."
- "You are probably going to be able to receive a larger amount of jobs and choose from a large amount because like I said engineering and accounting, managing those all relate to numbers and numbers relate to math so you probably are going to have a much large variety of jobs to be qualified for."
- "It helps you with stuff like dealing with money or the taxes when you are older."
- "My dad says you need to have...I can't remember exactly what he says but you need to have something to fall back on when you are working. You have main trait and you need something to fall back on. I kind of feel like writing, engineering something of that sort would be my main trait or like maybe photography. You know something of that sort would be to fall back on should that not work out. I feel like if I learn something in math then I am kind of following that."
- "I feel like math it is an essential."

Participants saw value in learning mathematics based on its connection to the future. However, it is worthy noting some participants feel that "a lot of stuff we learn in math won't really help us later on. Like it really doesn’t seem necessary.” Participant 9 felt that “some parts are really confusing…if you need to learn that for a certain career couldn't you do that in college? Seriously. Stop math in like tenth grade and if you need to learn anything else for a certain career do it in college.” Others felt that the work assigned can be “busy work at times.” In the end, “I feel like...you know if I am going to an arts college are they really going to care that much about my math grade? Probably not but I think that you need to learn those things just for the future.” The connection to the future varied from real-world application to job relatedness, however, all participants shared a belief that mathematics would be useful in the future. The result for participants was the common belief that math is valuable in terms of learning for future use unrelated to their liking or disliking of mathematics as a subject.

Self-perceived Competence

In the examination of participants’ positive and negative mathematical disposition, self-concept, and attitude include the belief that he/she is good or bad at math; self-perceived competence. In general, participants did not directly mention an inability to be successful in mathematics but instead shared how math was different from other subjects in that:

- “Challenge to figure out what you are looking for.”
- “Have to find the one right answer.”
- “Don’t know when you are right or wrong.”

Participants summarized these feelings by stating that, “math is hard,” “math is challenging” and “math is difficult.” One participant simply described math as “just a lot more difficult or harder to understand” while others clarified the belief that math is hard with “most of it is not hard – it just takes multiple steps,” “it is hard to understand at first,” and math requires “a lot of thinking power and work.”

There was no reference by individuals as having the inability to learn mathematics. Participant 12 identified math as “harder to understand, at least for me.” This same participant later noted that “if you are blessed enough to feel good with math then you will have a much easier time in finding a job and much easier time in succeeding in life because a lot of jobs that are easier to get requires much more left brain thinking” suggesting the existence of learning style differences reliant on left-brain and right-brain learning theories. “When you know the subject very well” or “when the subject is easy that makes you feel good” about math. Another participant added insight to the concept of ease relating to making an individual feel good by saying, “If I finish quickly – means I get it.” The connection between feelings and the development of self-competence was apparent from this data set.

Significance of Grades

All participants (100%) agreed “it is important for me to do well in math.” Participants additionally recognized relevance in learning mathematics placing the value in learning mathematics as a key to future success. Frequent in interview and survey responses was the value of grades and the impact grades have on the self-concept of students.

When asked specifically what makes students feel successful or unsuccessful in math, participants all referred to grades at some point in their response. Participants shared the value of grades in determining their feeling of success or lack of success in math a number of times:

- “Things that make me feel successful in math when I get a report back, like mini-homework, and I get 100% on them.”
- “Definitely grades make me feel successful. Even if I know I tried my hardest and got a C on it, I wouldn't be proud of my work or wouldn't feel too good as a math student.

Also if I hand in something that I know that is not high quality I will not feel good about the work because I know what my grade will be."

- "I was in a group for the piñata project, and it turned out we did a lot of the work wrong. I suppose that made me feel negatively towards math because it brought my grade down and that made me feel pretty bad."
- "Test grades make me feel not so good at all. Ds and Cs I get worried about them. I don't expect Fs. B minus' are not good. I feel like I could have done better and if it was one more worse than I could have gotten a C plus and that is not good at all."
- "The grading is of course going to have an effect where I am going to have to check everything."

Participants shared their goals of "getting 100%" and "striving for As." With the definition of a perfect classroom described as "a classroom where students get all As," it was not surprising to hear that "test grades C or lower" made students feel unsuccessful in math. Despite earning grades of As and Bs, one participant stated that "I am not very good at it." Students shared the belief that "grades C or lower are not good" and in fact, "B minus is not a good grade either since it is almost a C." The impact of grades on students' feelings towards mathematics was clearly stated by one participant who said, "If I know I tried my hardest but got a C, I would not be proud of my work or feel good as a math student." Such findings suggest a significance of grades on the development of students' self-concept.

All students within this study felt that it was important to do well in and get good grades in math. Participants referred to the challenges math provokes on their reflections of self; belief and perception of strengths, weaknesses, abilities, and attitudes to learn and do well in mathematics. Participants did not describe an inability to "do math" but some of the participants described a low self-perceived competence. The search for the one right answer, the multiple routes to find a solution and the amount of "thinking power and work" required in mathematics was described as making a student feel incompetent. The ease of finding an answer or completing a mathematical task quickly makes a student feel more competent and successful. As students encounter mathematical tasks that require extended amounts of time or pose challenges to their thinking, they perceive this as a lack of mathematical understanding which in turn lowers their perception of mathematical competence; "When the subject is easy that makes you feel good" and "If I finish quickly – means I get it." Even with good grades, students felt as if tasks that were challenging, requiring multiple steps or prolonged thinking and extensive time, lowered their self-concept of ability in mathematics.

Academic Press

Participants identified academic press as having a significant impact on their self-concept development. This concept of academic press can be defined as the degree that environmental forces press for students to succeed. The overall findings from the culmination of qualitative and quantitative data supported the concept of academic press via high-expectations, perseverance, and equity in the math classroom.

High-expectations

Through an analysis of survey data, the median responses for each aspect of the high-expectations were calculated to compare the average responses for each individual area of high-expectations. The median response describing the average participants' perspective on high-expectations in mathematics as seen in Table 6.

Table 6

Median Responses of Participants to High-Expectations in Math Class

		High Expectation Interventions								
		High standards	Challenging and achievable	High School Success	Not Expected to Fail	Held Accountable	Time and Instruction Provided	Provision of Different Learning Materials	Grade Level	Teacher Opinion
N	Valid	9	10	8	8	10	10	10	8	8
	Missing	1	0	2	2	0	0	0	2	2
	Median	3.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00

Note: Missing values are a result of participants selecting “I have not experienced this.

Most participants felt when “The math teacher sets high standards for learning and lets me know I am expected to meet them” and “The math teacher expects me to perform at a level needed to be successful the high school” (Mdn = 3, IQR = 2) it made them feel “Mostly Positive” towards math and their ability to be successful in mathematics. When “The math teacher lets me know that standards are both challenging and achievable,” “The math teacher does not expect me to fail,” “The math teacher provides time and instruction necessary to help me perform at acceptable levels,” “The math teacher provides time and instruction necessary to help me perform at acceptable levels,” “The math teacher gives me different learning materials just as interesting as materials provided to other students,” and/or “The math teacher encourages me to perform at my current grade level” (Mdn = 4, IQR = 1), the result was a “Definitely Positive” feeling towards math and the ability to be successful for most participants. This result extended to when “The math teacher holds me accountable for completing assignments, turning in work, and participating in classroom discussions,” “The math teacher has his/her own opinion of me and doesn’t listen to others’ opinions of me” and/or “The math teacher emphasizes that different students are good at different things and reinforces this by asking me to look at other students' work” (Mdn = 4, IQR = 2).

The responses from the participants (N = 10) were divided into positive and negative to examine the variability in the overall participant perspective of high-expectations in mathematics. Likert scale responses of 1= “Definitely Negative”, and 2 = “Mostly Negative represent a negative perspective. Likert scale responses of 3 = “Mostly Positive”, and 4 = “Definitely Positive” represent a positive perspective. A summary of participant responses divided into positive and negative self-concepts is shown in Table 7.

Table 7

Summary of Participant Perspective of High-Expectations in Mathematics

		Perspective of High-Expectations in Mathematics	
		Positive	Negative
High Expectations Interventions (N = 10)	The math teacher sets high standards for learning and lets me know I am expected to meet them.*	67%	33%
	The math teacher lets me know that standards are both challenging and achievable.	90%	10%
	The math teacher expects me to perform at a level needed to be successful the high school.**	75%	25%
	The math teacher does not expect me to fail.**	87%	13%
	The math teacher holds me accountable for completing assignments, turning in work, and participating in classroom discussions.	80%	20%
	The math teacher provides time, and instruction necessary to help me perform at acceptable levels.	100%	0%
	The math teacher gives me different learning materials	100%	0%

just as interesting as materials provided to other students.		
The math teacher encourages me to perform at my current grade level.**	100%	0%
The math teacher has his/her own opinion of me and doesn't listen to others' opinions of me .**	75%	25%
The math teacher emphasizes that different students are good at different things and reinforces this by asking me to look at other students' work.**	75%	25%

* One participant had no experience with this intervention in mathematics
** Two participants had no experience with this intervention in mathematics

The findings show an overall positive response from students when high-expectations are used as an intervention in the math classroom. The positive perspective represented by the percentages support the use of high-expectations in developing a positive self-concept of ability.

Only one participant connected good grades, "getting 100% on the test," with meeting high expectations. One participant in particular noted that "It is not just about getting good grades." Rather than noting grades when discussing high-expectations, participants talked about work ethic, focusing, understanding, "trying your best," "at least making mistakes," "work ability progression over the years" and "don't need to have the ability but at least good sportsmanship."

Perseverance

Within survey results, participants stated that "Work in math classes is easy for me" (70%) and "I learn things quickly in math" (60%). Participants referenced being a "hard worker" and the belief that perseverance was not only necessary in math but that students "learn to persevere through things" as result of math class. Math "can be difficult but another pro from it being difficult is that you learn to persevere through things and answer confidently." Math can be “time consuming” and challenging according to participants. “Perseverance kind of pushes. I feel like it is the key to success like if you don't persevere and you are always going to give up then you aren't going to get anywhere.”

Equity

Participants, however, felt it was important for the teacher to be an active member of setting the tone for success in the classroom. Based on the survey results from Table 7, the majority of participants felt it was important for the teacher to relay the message that the standards are both challenging and achievable and to hold students accountable for their work.

Additional findings from survey data as seen in Table 8, support the use of extra time and extra help by teachers in the classroom. The median responses for each aspect of the extra time and extra help were calculated to compare the average responses for each individual area of extra time and extra help.

Table 8

Median Responses of Participants to Extra Time and Extra Help in Math Class

		Extra Time and Extra Help Interventions				
		Teacher Tracks Learning	Extra Help	Communication of Learning and Behavior	Instruction and Study Strategies	Additional Learning Time
N	Valid	10	9	9	10	8
	Missing	0	1	1	0	2
Median		3.00	4.00	3.00	4.00	4.00

Note: Missing values are a result of participants selecting “I have not experienced this.”

Most participants felt “Definitely Positive” when “The math teacher makes notes on what I am struggling in and arranges for me to get help” and/or The math teacher gives me additional learning time whenever possible” (Mdn = 4, IQR = 1) as well as when “The math teacher provides me with instructions on how to study and strategies used by successful students" (Mdn = 4, IQR = 0). Participants felt "Mostly positive" when "The math teacher keeps track of my learning and knows when I am having trouble in math" (Mdn = 3, IQR = 0) and/or when "The math teacher communicates high learning and behavior to students and holds them accountable for meeting classroom standards" (Mdn = 3, IQR = 1).

The responses from the participants (N = 10) were divided into positive, and negative to examine the variability in the overall participant perspective of high-expectations in mathematics. Likert scale responses of 1= "Definitely Negative", and 2 = "Mostly Negative represent a negative perspective. Likert scale responses of 3 = "Mostly Positive", and 4 = "Definitely Positive" represent a positive perspective. A summary of participant responses divided into positive and negative self-concept of math learning is shown in Table 9.

Table 9

Summary of Participant Perspective of Extra Time and Extra Help in Mathematics

		Perspective of Extra Time and Extra Help in Mathematics	
		Positive	Negative
Extra Time and Extra Help Interventions (N = 10)	The math teacher keeps track of my learning and knows when I am having trouble in math.	100%	0%
	The math teacher makes notes on what I am struggling in and arranges for me to get help.*	78%	22%
	The math teacher communicates high learning and behavior to students and holds them accountable for meeting classroom standards.*	100%	0%
	The math teacher provides me with instructions on how to study and strategies used by successful students.	90%	10%
	The math teacher gives me additional learning time whenever possible.**	87%	13%

* One participant had no experience with this intervention in mathematics
** Two participants had no experience with this intervention in mathematics

As shown in Table 7, all participants shared the importance of the math teacher providing time and instruction necessary to help students perform at acceptable levels. One interesting finding is the 100% agreement from all participants in the value of time and instruction to help them perform at acceptable levels. This includes the importance of the math teacher providing students with different learning materials just as interesting as materials provided to other students. Again, participants were in 100% agreement that the provision of such materials supports their endeavor to be successful in mathematics.

The results from Table 9 show an overall positive response from extra time and extra help interventions used the math classroom. In fact, 100% of the participants felt it was just as important for their self-concept for the math teacher to keep track of their individual learning and know when each trouble is having trouble in math. The culmination of the data from both Table 9 and Table 11 signifies the importance of equity in developing a student's positive self-concept of ability in mathematics.

Feedback and Reinforcement

The findings support the use of feedback and reinforcement in developing a positive self-concept of ability in mathematics. Feedback was defined by participants as a way in which students can assess their mathematical understanding and focus on improvements for success in mathematics. Affirmation of accuracy from the teacher, feedback on goals and praise for accuracy and growth were all classroom practices, identified as interventions that help students to determine if they are understanding the mathematics being taught.

Utilizing quantitative data from the online participant surveys, the median responses for each aspect of the feedback were calculated to compare the average responses for each individual area of feedback. The median response describing the average participant's perspective on feedback in mathematics can be seen in Table 10.

Table 10

Median Responses of Participants to Feedback in Math Class

		Feedback Interventions								
		On Written Work	On Accuracy	On Goals	Accuracy and Growth	Based on Peers	Computer Based	Regular Homework	Quickly Corrected and Returned Homework	Peer Feedback
N	Valid	9	10	10	10	7	5	9	9	7
	Missing	1	0	0	0	3	5	1	1	3
Median		4.00	4.00	4.00	4.00	3.00	4.00	3.00	3.00	3.00

Note: Missing values are a result of participants selecting "I have not experienced this."

Most participants where "The math teacher gives me immediate feedback on my written assignments to help me understand and correct errors" and "I am assigned math activities on the computer that gives me immediate feedback regarding my learning performance" (Mdn = 4, IQR = 2) have the perspective that these interventions definitely make them feel positive towards math and their ability to be successful in math. This results are similar when participants have experienced "The math teacher gives me specific feedback related to the unit goals or overall math goals," "The math teacher gives me specific feedback related to the unit goals or overall math goals," and "The math teacher praises me for correct answers and for growth in relation to my past math performance" (Mdn = 4, IQR = 1) and well as "The math teacher lets me know when I am correct during class discussions, group work, on tests and on assignments" (Mdn = 4, IQR = constant with no range). "The math teacher gives me feedback in math based on evaluations my peers have completed" (Mdn = 3, IQR = 3)," The math teacher assigns math homework regularly" (Mdn = 3, IQR = 2), "My math homework gets corrected and returned quickly" (Mdn = 3, IQR = 1) and "My classmates give me feedback and reinforcement when they are helping or tutoring me" (Mdn = 3, IQR = 1) are all feedback interventions which were reported as making students feel "Mostly Positive" towards mathematics and their ability to be successful in mathematics.

The responses from participants (N = 10) were divided into positive and negative to examine the variability within overall participant perspective of feedback in mathematics. Likert scale responses of 1= "Definitely Negative", and 2 = "Mostly Negative represent a negative perspective. Likert scale responses of 3 = "Mostly Positive", and 4 = "Definitely Positive" represent a positive perspective. A summary of participant responses divided into positive and negative self-concepts is shown in Table 11.

Table 11

Summary of Participant Perspective of Feedback in Mathematics

		Perspective of Feedback in Mathematics	
		Positive	Negative
Feedback Interventions (N = 10)	Immediate Teacher Feedback on Written Work*	78%	22%
	Teacher Affirmation of Accuracy	100%	0%
	Feedback on Goals	100%	0%
	Praise for Accuracy and Growth	100%	0%
	Teacher Feedback Resulting from Peer Evaluations**	61%	29%
	Computer Feedback***	80%	20%
	Regular Homework*	57%	43%

Quickly Corrected and Returned Homework*	100%	0%
Peer Feedback**	86%	14%

* One participant had no experience with this intervention in mathematics
** Three participants had no experience with this intervention in mathematics
*** Five participants had no experience with this intervention in mathematics

The results show an overall positive perspective in response to feedback intervention in the math classroom. All participants were in agreement that teacher affirmation of accuracy, feedback on goals and praise for accuracy and growth provided them with an enhanced sense of self-concept in math. For some students, this meant having access to immediate feedback. "When I know I am correct, it makes me feel more confident that I understand the concept."

Participants did not deny the need for criticism but believed that a combination of both positive and negative feedback was best for positive self-concept development. Participants shared the desire for a teacher who does not criticize but instead a teacher who talks to the individual student, makes time for the individual, provides feedback throughout the class and beyond the group work, and gives good feedback followed by criticism.

Related to perseverance, the students in this study felt that a teacher should explicitly explain what a student got right or wrong, and what the student should focus on next time to make improvements. Students believe a combination of positive and negative feedback is an asset to classroom practices and helps to develop strong positive self-concepts in students. Too much of either positive or negative feedback, however, was termed as being harmful to students and should be avoided.

Social Support

Findings from Table 4 show the majority of participants (70%) felt that they "have always done well in math" leaving 30% feeling as if they have not always been successful in mathematics. All participants shared their math history and previous experiences in mathematics within their interviews and survey responses. No participants referenced being unsuccessful in mathematics during grades 1 through 2. However, from grades 3 onward, participants noted struggles, negative experiences and poor grades in mathematics. The result was a fluctuation in their both positive and negative dispositions towards mathematics from year to year.

Teacher-student Interaction

Participants made particular mention of the teacher during each shared experience. One participant identified positive feedback from the teacher as a way to increase confidence in math. “I am looking for the teacher to bolster my spirits.” For participants this included a “patient teacher,” “a teacher who will always help,” “a teacher I can go to multiple times,” and “a teacher who will work with me one-on-one.” “I don’t want the teacher to tell me how to solve a problem” but “a teacher who takes the time to explain” and “works with me on the steps” “in a learning style I understand.”

Teacher-student interactions were analyzed using quantitative data from participant surveys. The median responses for each aspect of the teacher-student interactions were calculated to compare the average responses for each individual area of teacher-student interactions. The median response describing the average participant’s perspective on teacher-student interactions in mathematics can be seen in Table 12.

Table 12

Median Responses of Participants to Teacher-Student Interactions in Math Class

		Teacher-Student Interactions			
		Social Interest	Communication of Interest	Develop Socially	Teacher Sharing
N	Valid	7	9	9	8
	Missing	3	1	1	2

Median	3.5	3.5	3.5	3.5

Note: Missing values are a result of participants selecting "I have not experienced this."

Most participants had feelings rated as "Definitely Positive" and "Mostly Positive" when "The math teacher pays attention to my social interests, activities, and problems," "The math teacher communicates his/her interest and care for me, verbally and non-verbally (such as giving me undivided attention, maintaining eye contact, smiling, or nodding)," "The math teacher encourages me to develop a sense of responsibility for school-related activities and to participate in making decisions about important school issues" and/or "The math teacher shares stories from his/her life with me" (Mdn = 3.5, IQR = 1).

The responses from the participants (N = 10) were divided into positive and negative to examine the variability in the overall participant perspective of teacher-student interactions in mathematics. Likert scale responses of 1= "Definitely Negative", and 2 = "Mostly Negative represent a negative perspective. Likert scale responses of 3 = "Mostly Positive", and 4 = "Definitely Positive" represent a positive perspective. A summary of participant responses divided into positive and negative self-concepts is shown in Table 13.

Table 13

Summary of Participant Perspective of Teacher-Student Interactions in Mathematics

		Perspective of Teacher-Student Interactions in Mathematics	
		Positive	Negative
Teacher-Student Interactions Interventions (N = 10)	The math teacher pays attention to my social interests, activities and problems.***	86%	14%
	The math teacher communicates his/her interest and care for me, verbally and non-verbally (such as giving me undivided attention, maintaining eye contact,	89%	11%

smiling, or nodding).*		
The math teacher encourages me to develop a sense of responsibility for school-related activities and to participate in making decisions about important school issues.*	100%	0%
The math teacher shares stories from his/her life with me.	87%	13%

* One participant had no experience with this intervention in mathematics
** Two participants had no experience with this intervention in mathematics
*** Three participants had no experience with this intervention in mathematics

The results show an overall positive response from teacher-student interactions interventions in the math classroom. The frequencies of responses represented support teacher-student interactions interventions in developing a positive self-concept of ability in mathematics.

Peer-peer Interaction

In alignment with the internal/external (I/E) frame of reference model (I/E model), the participants compared their abilities in math with the abilities of other students. Participants shared stories of success and their best math experiences where the perception or opinion of their peers made an impact on how they felt about their learning and self-concept in mathematics. They additionally shared stories where they felt unsuccessful in math and some of their worst experiences in math. The result was insight into how the interactions with peers, positive and negative, have an impact on students' academic self-concept, the Peer Emulation Theory in action (Lee & Shute, 2010).

Instructional Groups

The median responses for each aspect of the group work was calculated to compare the average responses for each individual area of group work. The median response describing the average participant's perspective on group work in mathematics can be seen in Table 14.

Table 14

Median Responses of Participants to Group Work in Math Class

		Group Work Interventions								
		Whole Class Lessons	Ability Grouping	Check-Ins	Movement Amongst Levels	Small Group Instruction	Group Reward for Success	Individual Accountability	Peer Tutoring	Mixed Gender Grouping
N	Valid	10	10	10	9	9	8	9	7	7
	Missing	0	0	0	1	1	2	1	3	3
Median		3.00	4.00	4.00	3.00	4.00	3.00	3.00	2.00	3.00

Note: Missing values are a result of participants selecting “I have not experienced this.”

Most participants who have had experiences when “The math teacher puts me in a group based on my abilities in math” (Mdn = 4, IQR = 1) or “The math teacher checks on my group a lot to make sure we understand the math content” (Mdn = 4, IQR = 2) or “The math teacher forms small groups for instruction and practice” (Mdn = 4, IQR = 1), it makes them feel “Definitely Positive” towards math and their abilities towards math. Most participants stated that when “The math teacher teaches a lesson to the entire class when introducing a new math concept or skill” it makes them feel “Mostly Positive” towards mathematics and their abilities in math (Mdn = 3, IQR = 1). When “The math teacher puts me in a group and promises us a reward if our group is successful” (Mdn = 3, IQR = 2) or “The math teacher puts me in a group and tells me I am responsible for my own work,” (Mdn = 3, IQR = 1) or “The math teacher makes sure that the group I am in has both boys and girls in it,” (Mdn = 3, IQR = 1), or even if “The math teacher moves me to a high level group when I understand the topic” (Mdn = 3, IQR = 1), most participants who have had experiences with these interventions feel “Mostly Positive” towards math and their abilities in math. Most participants who have had experience with “The math teacher assigns students in the class to help and tutor me during the class period’

(Mdn = 2, IQR = 1), state that this teacher behavior makes them feel “Mostly Negative” towards math and their abilities towards math.

The responses from the participants (N = 10) were divided into positive and negative to examine the overall participant perspective of on group work in mathematics. Likert scale responses of 1= “Definitely Negative”, and 2 = “Mostly Negative represent a negative perspective. Likert scale responses of 3 = “Mostly Positive”, and 4 = “Definitely Positive” represent a positive perspective. A summary of participant responses divided into positive and negative self-concepts is shown in Table 15.

Table 15

Summary of Participant Perspective of Group Work in Mathematics

		Perspective of Group Work in Mathematics	
		Positive	Negative
Group Work Interventions (N = 10)	Whole Class Lesson	100%	0%
	Ability Grouping	80%	20%
	Check-ins	80%	20%
	Movement Amongst Levels *	100%	0%
	Small Group Instruction*	89%	11%
	Group Reward For Success**	80%	20%
	Individual Accountability*	100%	0%
	Peer Tutoring***	0%	100%
	Mixed Gender Grouping***	100%	0%

* One participant had no experience with this intervention in mathematics
** Two participants had no experience with this intervention in mathematics
*** Three participants had no experience with this intervention in mathematics

The results show an overall positive response from group work interventions in the math classroom with the exception of peer tutoring (100%). The frequencies of responses represented support group work interventions in developing a positive self-concept of ability in mathematics.

In conjunction with other aspects of the interview as well as the written responses provided with the survey, participants were asked explicitly about group work, what they thought about group work and how it functioned in the classroom. Participants took this opportunity to delve into their values, beliefs and emotions in relation to working with their peers.

The overall consensus from participants was working with peers, in group situations, was a valuable intervention in the classroom and in their learning environment. As one might expect from middle school students, the opportunity to work with others is a time to socialize which is lacking in their most of their schooling at the middle level. However, beyond the social aspect participants recognized group work as a chance to "cooperate in groups," "split the workload," and "collaborate." Participants saw group work as a positive learning experience in math due to the supports they gain from working with peers where:

- "I can use other students' strengths to help the group."
- "I can get help from peers."
- "I can bounce ideas off other group members."
- "Peers can help me to learn."
- "Peers can help me to understand a concept."

Participants shared concerns with group as well. Relating to students' high expectations, and the impact of grades, all participants discussed the student accountability. Despite "better than working alone," participants recognize those students who "have a lower work ethic" or "pull me off task" as having a negative impact on their ability to get good grades. The vast majority of participants shared the importance of individual accountability when working in group situations. This can be related to the fact that the majority of participants value a math teacher who communicates high learning and behavior expectations to students and further holds students accountable for meeting classroom standards.

Participants discussed the importance of group member selection. Students recognized that choosing friends can be seen as a negative by the teacher. If the teacher chooses the group members, students recognized the value of working with new students, or being placed in a group based on leveling. However, students prefer to choose their own groups based on the ideas that:

- "It is easier to communicate with them – used to talking to them."
- "They are willing to spend a lot of time out of school on a project."
- "They have the same aspirations to do well."
- "They know how to work together."
- "It is better if pair up with a person you know you can work well with."

When the math teacher assigns students in the class to help and/or tutor peers during the class period, participants indicate resulting negative feelings towards math and their ability to be successful in mathematics. "I think math is one those subjects that if you don't know it you are dumb." From this perspective, the competiveness and comparison to peers arises.

- "None of these kids know how to do it but I am the only one that knows how. It makes me feel good about myself. I feel confident. That is probably what helps me get better in math."
- "We all go to the teachers sometimes, not to purposely annoy her, but ask her as group. It is kind of fun too because when she tells us that one person is correct then

you get bragging rights. That's only just for fun sometimes."

- "One time I got the homework and nobody else really did so they were like you can move onto this activity while I stay back and help these kids. That made me feel good."
- "I like playing sports. I am not competitive in the sense that I want to get it right and them get it wrong. If I can finish a worksheet first, it is definitely a good feeling to know that you finished first because you understand or you're getting the questions right because you found a way to use what the teacher taught you and also use what you're thinking."

In conjunction with the previous statements made by participants and the following student shared experiences, it is clear that students sense of self in math is impacted by their peers in both negative and positive ways

- "It makes me a little less positive if I am in the group that needs the most work. To me I feel positive as long as I'm not in the group that needs the most work."
- "When everyone in the class understands whatever we are doing and I don't understand it and I feel like I am the only one who doesn't then I feel like I am not catching up."
- "It is hard to see someone in your class way ahead of you and thinking you have to catch. I know that if I am getting questions wrong over and over that is usually why. I am going too fast trying to catch up with everyone."
- "I don't mind working with others, but when it is people my age having to tutor/help me, it makes me feel worse at math than everyone else."
- "I hate when we go around and share our answers for homework. That makes me feel

pressured and that if my answer is wrong I will embarrass myself in front of the entire class."

- "It makes me pretty proud that I know the math that well to be able to be in the higher group. It makes me feel that I actually know what I'm doing more. But, it still makes me feel that everyone else in the group is better than me."
- "I do not feel as though it is considerate for a teacher to have another student tutor me during class. If I really needed tutoring I would prefer to do it after class and not in front of all of my friends."

The social support data aligns with Vygotsky's Social-Constructivist Learning Theory and helps with the analysis of the data. The connection the students make here reflects the idea that learning is a social process shaped by external forces where knowledge is formed via interactions with others and the environment (Palincsar, 2005). As students suggest the need for social interaction from peers and teachers to support their learning, the construct of self-concept being a learned behavior is supported.

Peer Tutoring

Reflecting on the need for social interaction through peer-peer interactions all students proposed the previous classroom practices which they perceived essential to working in groups during math class. When referring to peer tutoring, the majority, but not all students had experience with this practice in the classroom. Of those students who did have experience with peer tutoring, 100% felt that it was a negative in terms of helping students to feel successful. What students felt was having a peer, a person who supposed to be on the same "level" of learning, help to learn a subject, rather than the teacher, brings about a sense of incompetence. However, for those students who were on the teaching end of the peer-peer tutoring, the feeling of being “smarter” than another person made that individual feel good about the mathematical understanding.

With the conflicting views presented by participants, it was hard to come to a clear and concise conclusion as to whether or not peer tutoring has a positive or negative impact on a student’s self-concept. An area worth further study is how peer teaching can be used to develop a positive self-concept of ability in mathematics.

Modifying the Learning Environment

Participants described a learning environment that fit their needs as a middle school math student, one that related the mathematical content to their lives in a practical and meaningful manner. Participant interviews allowed students to share their needs for the math classroom and the modifications they saw fit for the best mathematical learning environment. Some participants mentioned the layout of the classroom or the materials in the classroom but all students mentioned the relevance the subject matter. All participants felt that the mathematics that was taught to them needed to involve some sort of “fun.” Difficult to define, participants frequently shared the desire for teachers to make class interesting, creative and related to student interest. All students claimed math was “boring.” When asked to expand upon what they meant by “boring,” participants were able to express their thoughts and share ways in which the math classroom could be modified to fit their needs.

Relevance

The vast majority claimed that math would be much more interesting if it were related to individual interests or at least related to something real-world. “Math is different than other subjects.” Participants were clear in making this differentiation between math and their other classes. “It is different than other subjects because other subjects have different outcomes.”

Participants viewed math as limited in its allowance for creativity. “Math has one right answer” while other subjects allow for different answers. The result was the participants’ request to make math related to the real-world and application. For participants, making math relevant would make it fun and interesting to learn.

The findings from the study show that students see the validity and value in studying mathematics. Students understand the value of learning mathematics as it relates to their futures in the context of their education and careers. Not once did a participants claim mathematics to be a subject not worthy of learning. In fact, many students were able to identify the reason for learning math as it was related to real-world applications. Students understood mathematics to be a valid tool for many jobs, which they may participate in the future. Students also recognized the vast amount of lessons, skills, tasks and lessons that they are held accountable for that they may never use in the future. Despite this recognition of the mathematics being taught as not directly correlated to their future career choice, students considered success in mathematics as essential based on its importance for future success.

Learning Styles

Following from the yearning for relevance was the suggestion of a direct positive correlation between students’ math experiences and their self-concepts of ability. The students who participated in this study frequently referenced the connection between their learning styles and their development of self-concept in mathematics. As students shared their mathematical stories they included snapshots of learning styles they had experienced in the classroom that fit their needs. Of particular interest was the suggestion that a positive experience with a learning style resulted in a positive self-concept and positive mathematical disposition. The inverse was also suggested where a negative experience with a learning style was associated with a negative self-concept and negative mathematical disposition. When mathematics is taught in a manner that connects to their learning strengths, they are better able to not only access the mathematical content but also add to their vision of mathematics.

Participants frequently discussed learning styles within the classroom. “Teachers have been teaching a long time and know what they are teaching already.” Participants felt that teachers should take the time to plan lessons that directly addressed students’ learning styles. The vast majority of students mentioned that note-taking was not a valuable mode of learning in the math classroom. “Just because I am taking notes, doesn’t mean I am learning.” The suggestion made by a few participants was to provide notes to students rather than taking time in class to record notes. The feeling was that they would rather be “doing” math rather than copying notes.

As students discussed the various learning styles they had experienced in the classroom, both positive and negative, there appeared to be a direct positive correlation between the experience and their self-concept. As students described a learning style that fit their needs they described a self-concept, which was positive and displayed an overall positive mathematical disposition. The inverse was also seen where a negative experience with a learning style was associated with a negative self-concept and negative mathematical disposition. It may be of interest for future studies to examine the suggested relationship between learning styles in the math classroom and the development of a student’s self-concept in mathematics.

Summary

The purpose of this case study was to examine middle school students’ self-concept of ability in mathematics as it is related to the positive mathematical disposition of middle school students’ achievement in mathematics. Chapter 4 provides results and data collected from research participants as they relate to the purpose of this case study.

The organization of themes provided an examination of students' self-concept of ability in mathematics. This first theme was followed by findings related to the multidimensionality of students' attitudes towards mathematics which consisted of students' vision of mathematics and self-perceived competence. The third theme discussed the significance of grades on students' self-concept of ability in math. The result of the theme formulation facilitated in what middle school students defined as their self-concept of ability in mathematics.

The intent of the study was to investigate ways in which leaders can enhance the quality of teaching and learning via the perception of the student and the enhancement of a student's sense of self-concept of ability in mathematics (Wigfield & Karpathian, 1991; Winheller et al., 2013). In conjunction with the examination of students' self-concept, themes from the data helped to identify interventions deemed by students as positive supports for self-concept development in mathematics. Perseverance, equity, and high-expectations were organized to create academic press. Academic press was followed by the need for social supports made up of teacher-student and peer-peer interactions. Lastly modification to the learning environment, discussed the value of relevance, and learning styles in supporting students' self-concept in mathematics.

The culmination of the themes presented supported the development of several conclusions. The conclusions, to be discussed in Chapter 5, help to fill lack of research available in the examination of middle school students' math achievement and positive mathematical disposition and provide the student perspective related to which teacher/classroom interventions specifically impact the middle school math students' self-concept of ability.

CHAPTER 5

CONCLUSION

The purpose of this mixed methods case study was to examine students' self-concept of ability in mathematics as it relates to the positive mathematical disposition of middle school students' achievement in mathematics. As notes in Chapter 1, the focus of this research was not investigate the relationship between middle school math students' attitudes and their levels of math achievement nor was the intent to prove or disprove research connecting age, gender, culture, and mindsets to the development of a student's attitude towards mathematics. The intent of this study was to develop a better understanding as to how students identify their self-concept of ability in mathematics and find ways in which stakeholders can enhance the quality of mathematical teaching and learning by listening to the voice of middle school students.

Foundational to this research was Vygotsky's social-constructivist learning theory. Used as the theoretical frame for the study, it is understood that learning is a social process shaped by external forces where knowledge is formed via interactions with others and the environment (Palincsar, 2005). The combination of Vygotsky's social-constructivist learning theory and Marsh/Shavelson's model of self-concept in conjunction with a literature review, helped to identify gaps in research and pose the following research questions:

- How do middle school students describe their self-concept of ability in math?
- What teacher/classroom interventions are recognized by students as having an impact on their self-concept of ability?

As a result of searching for the answers to these questions, several conclusions were drawn solidifying the perception of students as it relates to their self-concept and positive mathematical disposition. The self-concept of ability in mathematics presented by the participants within this case study was positive. A researcher, who stopped at this point in the study, may have assumed then that mathematical achievement, attitude and disposition towards mathematics would also be positive. However, taking the time to gather qualitative data beyond the simplicity of the Likert scale allowed further insight into the self-concept of students' ability in math. Interview content clarified the perceptions of students and allowed them to identify aspects of classroom practices that they feel support the development of a student's self-concept of ability in mathematics.

Student voice and perception provided a pathway to classroom and teacher practices that support the growth of one's self-concept. It was clear from student data, that grades play a significant role in the self-perceived competence levels of students. Students additionally identified the need for change in the classroom based on academic press, learning styles, social interaction, and teacher-student interactions. Participants also shared their belief that mathematics is a unique subject requiring delineation from other subject matters, especially when examining the self-concept of students. However, the mixed methodology approach chosen for case study broadened the scope of the research beyond the search for answers to the proposed research questions.

It was concluded through this study that the self-concept of middle school students is malleable and fluctuates as the mathematical experiences. The basis for this fluctuation is dependent on the fit of the learning experiences and not necessarily prior achievement. With fluctuation and changes in the stage-environment fit for students, their self-concept and mathematical disposition is constantly in flux. Both the positive and negative mathematical disposition of students becomes unpredictable based on their ever-changing self-concept.

Therefore, a positive self-concept becomes unreliable in terms of predicting a positive disposition towards math leading one to believe that the development of self-concept is not a significantly reliable educational concept to focus on in terms of helping students to progress in math achievement. The findings of this research prove otherwise and suggest a focus on the self-concept as a valid connection to math achievement.

Interpretation of Findings

Middle school students described their self-concept of ability in math and what teacher/classroom interventions are recognized by students as having an impact on their self-concept in mathematics. Students clearly recognized mathematics as a unique academic domain where math appears as different from other core subjects. Students also clearly described their self-concept as not stable in mathematics; one that is malleable and fluctuating. As a result it was concluded that prior achievement is not a predictor of self-concept of ability in mathematics and that a middle school student's positive self-concept of ability in math does not guarantee a positive mathematical disposition.

When documenting findings to the questions posed by the study, the results highlight interesting data, facts and themes. However, just as interesting was the identification by students of aspects of the classroom teaching and learning experience, which impact their self-concept. Students identify competence with grades making the focus of grades a key factor in self-concept development. Students also identified the significance that academic press has on their self-concept of ability in math, requiring stakeholder attention to these addressing such development in the learning environment. Most important was the yearning by students for a classroom that fits. Students are looking for increased social interaction and supports in their learning experiences as they clearly identified teacher-student and student-student interactions as essential factors in the development of positive self-concept of ability in mathematics. For middle school students it is essential have a learning environment tailored to their academic, social and emotional needs.

As a result of analyzing students' descriptions of self-concept and classroom implications to guide positive development in self-concept, it was clear that students are seeking changes in classroom practices in the math classroom. Students are looking beyond skill development in the area of mathematics. Students are looking for changes in the classroom that fit their needs specifically in terms of social supports.

Students View Mathematics as a Unique Academic Domain

The intent of this study was not to examine the internal factors where students compare their individual abilities in math to their individual abilities in another subject but to examine mathematics as a separate academic domain. Participants based their competence in mathematics on both internal and external factors as expected from the I/E model. Of significance in participant responses was the specific focus on mathematics as a subject different than other school subjects. The separation of mathematics from other academic subjects in describing one's self-concept of ability in mathematics was apparent in participant interviews and written responses.

As students reflected and shared individual self-beliefs in math, they referenced self-perceived competence; whether or not they were good or bad in mathematics. As students described their dispositions toward mathematics, they clearly shared their feelings in terms of mathematics being "different" from other subjects. Students described mathematics as a subject requiring a different type of thinking, limited in terms of solutions and more challenging in relation to other academic subjects.

The self-reflection or self-perception of middle school students may not be deemed as "accurate," as students are apt to inflate and even underestimate their abilities in mathematics. However, it was the purpose of this study to gain the perspective of the student. Based on the perspective of the students in this study, however, math is unique academic subject requiring a specific attention to its domain specific, multidimensional, hierarchical self-concept.

Self-Concept is Malleable and Fluctuating

As a result of this research, it can be concluded that the self-concept of students is malleable and fluctuates as students have various mathematical experiences just as it was suggested in research done by Booth and Gerard (2012). Students consistently referred to mathematics as being easy from kindergarten through second grade. This consistency through second grade aligns with research claiming the relatively stable identification of self during this stage of development in a student. However, as students shared their mathematical histories from third grade through middle school, changes in students' self-concept, achievement and attitudes were apparent. From third grade onward students shared stories of negative mathematical experiences, mathematical struggles and feelings of negative towards mathematics that changed from year-to-year and grade-to-grade. According to this case study, as students develop in their sense of self, feelings of pride, shame and overall awareness of personal strengths and weaknesses, their self-concept of ability and attitudes towards mathematics fluctuate.

As students have different experiences in mathematics, their attitudes, self-concept and levels of achievement change according to the mathematical experiences. This fluctuation identifies an opening for educators to make positive changes in the self-concept of students and make further make a positive impact on students' math education. Students with a positive self-concept are more likely to persevere and continue to strive for success while those with a negative self-concept are described as students who are more likely to give-up. Knowing that students' self-concept fluctuates, it is likely that the achievement levels of students and possibly their mathematical disposition fluctuates as well. For this reason it is recommended that students' self-concept of ability is assessed regularly to determine which interventions might be implemented into the math classroom to develop positive self-concepts amongst students.

Achievement and Self-Concept are not Predictors

The reciprocity between a student's current positive self-concept and current success in mathematics was apparent in this study. Following from the reciprocal effects model, a student with a positive self-concept in mathematics is expected to perform at a high level of achievement and have a positive attitude towards mathematics. All participants in this study shared high levels of achievement and expressed positive self-concepts of ability in math. With an overall positive self-concept, one would assume students had been successful in their previous years of math. The negative self-concepts, attitudes and levels of achievement should have resulted in a progression of poor achievement through eighth-grade. However, students in this study shared their levels of achievement in eighth-grade mathematics as being relatively high with grades of As and Bs, conflicting with the expectancy-value model of Eccles. Based on the findings of this study, it would be theoretically sound to conclude that prior success or lack of success is not a reliable predictor of a student's self-concept in mathematics.

Accurately Measuring Self-Concept and Disposition

The majority of participants within this study, despite a positive self-concept of ability in mathematics, claimed they did not have a history of always doing well in mathematics or having positive feelings towards mathematics. When asked to use a Likert scale to answer questions from the Academic Self-Description Questionnaire II (ASDQII), eighth-grade math students from this case study described their self-concept of ability as relatively positive. These same participants described the significance of getting good grades and their personal history of getting such grades (i.e. As and Bs) in math class during middle school (grades seven and eight). However, the combination of a positive self-concept and a history of good grades did not guarantee a positive mathematical disposition towards mathematics.

Having shared relatively high performance grades in mathematics, one would expect that students would have a positive self-concept and a positive disposition towards mathematics. However, similar to research done by Bouhlila (2011), despite high levels of achievement and a positive self-concept of ability in mathematics, participants in this study exhibited a negative disposition towards mathematics with comments such as “Math has never been my favorite and never will be” and “I don’t really care about math.” Despite the good grades and positive self-concept, students shared negative attitudes, beliefs, feelings, and emotions with respect to mathematics during their interviews and within their written responses.

The qualitative data collected for this study provides a detailed description of the students’ self-concept of ability, including feelings, beliefs and values that help to define an individual’s self-concept. The Likert scale, however, did not capture these affective concepts and therefore failed to capture the negative mathematical disposition held by participants. Taking into consideration literature and the foundations of the reciprocal effects model, the positive self-concept shared by the Likert data would lead one to believe that the students also had positive attitudes towards mathematics and therefore a positive mathematical disposition. This was not the case, however, and raises the question as to what, if any, correlation exists amongst self-concept, attitude and mathematical disposition. A second question may be the accuracy and validity in using a Likert scale in to measure self-concept of ability in mathematics. There is a need for researchers to dig deeper into students' experiences in math, rather than trust the simplicity a Likert scale data to assess the students' self-concept of ability in mathematics. In fact, a possible area of further research is whether or not there exists a strong positive correlation between self-concept of ability and one's mathematical disposition towards mathematics.

The qualitative data from this study support detailed descriptions of the students' self-concept of ability, including feelings, beliefs and values that help to define an individual's self-concept. The Likert scale, however, provided an overview of the participant's self-concept but it did not provide the detail needed to gain insight into the mathematical disposition of the individual. It is recommended that future research interested in the self-concept of students investigate alternative quantitative instruments or choose qualitative methodologies to gain a true perspective of the self-concept of students and further their mathematical disposition towards mathematics.

Competency with Academic Press over Grades

Students based their perceptions about their competence in mathematics on their grades; formative and summative. Much of the mindset with which students approach their math classes is reliant on their grades. For students, earning an A or B in math is the goal and signifies success in math. This mindset correlates with the belief that achievement depends on skills and knowledge attainment, the cognitive domain, and is expressed with traditional letter grades and/or percentages. The feelings, the affective domain, that result from these grades help to define the student's self-concept in mathematics. The combination of feelings from not having learned a concept and the feelings that can result from any grades align with the Social-Constructivist Learning Theory where achievement in mathematics relies on both the affective and cognitive domains.

Participants identified academic press as having a significant impact on their self-concept development. Academic press, or the degree to which environmental forces pressured students to succeed, came from the external factors of high-expectations and equity in the math classroom but was also combined with the internal factor of perseverance.

The results of this case study reinforce the role of perseverance in the development of a positive self-concept in mathematics. Participants never referenced the need for lower standards, a decrease in challenges, or even less work. The findings from this research support the value of rigor and high expectations for all students with the understanding that students want to be successful in mathematics. This may be as a result of thinking that students with a positive self-concept tend to persist at a task while students with a negative self-concept tend to give up more easily. In any every sense of the meaning, participants referenced a desire for academic press as a classroom practice that support the development of a positive self-concept and mathematical disposition.

The overall feeling of participants in this study was that the communication of high-expectations and accountability in the math classroom is valuable in making them feel successful in their mathematical abilities. Participants specifically identified with standards that are both challenging and achievable, being held accountable for completing assignments, turning in work, and participating in classroom discussions, differentiated learning materials and the provision of instruction as well as time to aide students in achieving at acceptable levels. Participants additionally identified extra time and extra help in mathematics as key interventions specifically noting that math teachers, who keep track of student learning, acknowledge struggling students and provide study tools and strategies are the ideal. All participants of the case study stated the following high-expectation and equity interventions as having a positive impact on their self-concept of ability in mathematics:

- The math teacher lets the student know that standards are both challenging and achievable.
- The math teacher holds the student accountable for completing assignments, turning in work, and participating in classroom discussions.
- The math teacher provides time, and instruction necessary to help students perform at acceptable levels.
- The math teacher gives students different learning materials just as interesting as materials provided to other students.
- The math teacher keeps track of student learning and knows when the student is having trouble in math.
- The math teacher provides the student with instructions on how to study and strategies used by successful students.

The significance of academic press and grades lies in the impact these constructs have on the development on one's self-concept and mathematical disposition. Negative feelings and/or experiences such as those explained by grades in mathematics, lend themselves to the formation of a negative mathematical disposition. Knowing what researchers know about the impact positive impact academic press can have on both disposition and self-concept, it is worth the consideration by those in education on how to best utilize academic press rather than traditional schematics to develop positivity in both areas.

Students Want a Classroom that Fits

Di Martino and Zan (2010) asked the question, "Assuming both the possibility and the need of changing a student's attitude towards mathematics, how can the teacher act towards change?" (p. 45). In the search for an answer to this question, the voice of the students became a valid source about what students described as mathematical experiences that are relevant to their lives and related to their personal learning styles. Students described changes in the classroom that fit their needs in the moment, or what is defined as a *stage-environment fit perspective* (Eccles & Midgley, 1989; Eccles et al., 1993).

From the perspective of these students, classrooms are based on the real world as defined by educators rather than how students are experiencing the real world. In other words, teachers prepare lessons pertaining to purchasing a car, buying a home, and calculating interest rates or taxes pertain to the adult world and not that of a middle school student. As described earlier in this chapter, the participants identified math as a subject vastly different from their other school subjects; abstract and often unrelated to the lives of the middle school student. Participants did not deny the value of mathematics, however, they often do not recognize the value of the subject as it relates to their current status as a student.

Self-Concept is a term used to describe "an individual's perception or belief in their ability to do well" (Wang et al., 2012, p. 1215) and a way in which students "perceive their strengths, weaknesses, abilities, attitudes, and values" in mathematics (McInerney et al., 2012, p. 250). Despite the lack of literature referencing learning styles within this study, addressing the learning styles of students is recognized as a significant intervention for middle school math students with a possible connect between learning styles, self-concept and disposition. It may be of interest of future studies to examine the suggested relationship between learning styles in the math classroom and the development of a student's self-concept in mathematics.

Social Interaction in the Classroom Supports Self-Concept Development

The results from this study signify the importance social interactions have on the development of a student's self-concept in mathematics. Participants continually referenced the impact interactions with their math teachers had on their feelings in being successful in mathematics. Adding to these interactions were the values and beliefs students held in terms of social interaction with peers.

Teacher-Student Interaction

Participants from this case study were clear in their desire for teacher positivity and care in the math classroom. The challenge in analyzing this specific data was consistent with behaviors students viewed as positive and caring. All participants felt that a teacher who shared anecdotes and incidents from their experience helped to build rapport and understanding. From this point, participants varied in what they deemed as supportive based on the fact that not all participants had experienced the same kinds of teacher-student interactions. However, the following interventions were posed as having a positive impact on the self-concept of those students who had experiences with the teacher who:

- pays attention to student interests, problems, and accomplishments in social interactions both in and out of the classroom.
- encourages student effort, focusing on the positive aspects of students' answers, products, and behavior.
- communicates interest and care to students both verbally and through such nonverbal means as giving undivided attention, maintaining eye contact, smiling and nodding.
- encourages students to develop a sense of responsibility and self-reliance.

Included in the sense of teacher positivity and care, feedback and reinforcement were recognized by participants as driving forces in the development of a positive self-concept. Simply telling a student that he/she is good at math does not make a significant impact on that student's self-concept in math. Knowing this puts strength in the findings of Guay et al. (2003) that suggests the need for classroom practices to facilitate the relationship between a student's self-concept of ability and achievement in the math classroom.

Peer-Peer Interaction

Students referred to their ability to focus on mathematical content despite the challenges of working with individuals with whom they may or may not have a positive relationship. Peer to peer interactions were viewed by participants from different perspectives. The deciding factor for much of the opinion on peer-peer interaction relied on whether the relationship amongst the students was a "friend" or not. Although deemed as a distraction at times, participants believed some of their best work math work occurred when working with friends both in the classroom and outside of the classroom. Working with a friend was deemed as a more comfortable working relationship where collaboration, openness, and honesty come naturally.

Peer Emulation Theory is supported by the results where peers are said to have an impact on the self-concept of students. However, further studies could examine how special relationships or friendships have an impact on the self-concept of students; especially when it comes to using peers for tutoring in the math class where 100% of participants did not see peer tutoring as a classroom practice that supported a positive self-concept in math.

Implications

Nadler (2006), in describing his congruence model of change, stresses the importance of not only knowing what is happening in an organization such as school but also what changes have already happened. With this perspective about change, the overall student to school fit can be better understood and interventions can be put into place for effectiveness, as “the tighter the fit, the greater the effectiveness” (Nadler, 2006, p. 259). The results of this case study support this model through an examination of students’ self-concept of ability in mathematics and the interventions perceive as being valuable in creating a “tight fit.”

Literature identifies a dip in self-concept in all domains during the middle school years. The implication of this dip is fewer students will pursue mathematics during high school, college and then further into career choices. And despite this threat, little research has focused on teacher and classroom interventions that can be put into place to specifically support positive change in middle school students’ self-concept of ability of ability in mathematics (Cotton, 1995).

The identification of mathematics as a unique subject and a subject different from others supports the needs for a specific focus on mathematics as its separate entity. From this study it is understood that students have a vision for mathematics and see value in the subject. Students have set goals for high levels of achievement and place a great significance on getting good grades. And despite previous negative experiences with mathematics, there is the potential to reshape the negative self-concepts of students into ones, which are positive. Such pro-action is important for teachers and stakeholders to recognize. As students step into the math classroom with negativity towards math, this study suggests that there is still hope in changing their mathematical dispositions to ones, which inhibit positivity.

If improvements are expected in middle school math achievement, math interventions should extend beyond math skills alone. Essential to positive growth in the mathematical disposition of students is the implementation of teacher and classroom interventions that support students’ positive self-concept of ability in mathematics. It is the classroom-learning environment that contributes to important student outcomes such as self-concept and the creation of a stage-environment fit for middle school students (Lazarides & Watt, 2015). The challenge has been determining the right interventions to develop a proper stage-environment fit for middle school students.

Research shows a decrease in mathematical achievement, attitude and self-concept of ability during the transition to the middle school years. Research has also shown that gender, age, race and socio-economic status impact the development of a student's self-concept. This study, however, takes into consideration the perceptions of the student in terms of the interventions students deem supportive in the development of a positive self-concept in mathematics. Practical implications are suggested for classroom and teachers that ask stakeholders to look beyond prior achievement and to reflect on the stage-environment fit of the middle school classrooms.

The participants of this study suggest classroom and teacher interventions to support the affective domain of their learning. With the suggestions posed by students, researchers can assume that the implementation of such practices in the math classroom will have a positive impact on students' self-concept of ability in mathematics. As proposed by the findings of this study, the development of a positive self-concept does not guarantee a positive mathematical disposition. However, as suggested by Nadler (2006), the interventions posed by the participants may not make everything fall neatly into place, but it is the responsibility of teachers and stakeholders to implement at least one or two changes to to fill the gaps in students' education.

Recommendations for Action

If improvements are expected in middle school math achievement, math interventions should extend beyond math skills alone. Essential to positive growth in the mathematical disposition of students is the implementation of teacher and classroom interventions that support students' positive self-concept of ability in mathematics. It is the classroom-learning environment that contributes to important student outcomes such as self-concept and the creation of stage-environment fit for middle school students (Lazarides & Watt, 2015). Stakeholders who are concerned with the future of STEM careers, the achievement of middle school math students and the development of positive mathematical dispositions should be aware of the stage-environment fit perspective and the fluctuation that middle school students' self-concept of ability in mathematics can have on their mathematical disposition and achievement. Examining students' self-concept of ability in mathematics and gaining a perspective about which interventions have an impact on their self-concept in mathematics can support positive changes in attitudes towards mathematics and math performance. The students can articulate their feelings towards mathematics, their self-concepts of ability in mathematics and the perspective of which interventions make an impact on their self-concept in mathematics.

In the advancement of curriculum and instruction, it is recommended that students' self-concept of ability become a focal point in the teaching and learning of mathematics. The collection and analysis of data related to the students' self-concept of ability in mathematics allows for a continued awareness of students ever-changing self-concept and the changes which are needed to positively impact students' dispositions and mathematical achievement. The sharing of such interventions and adaptations to math programs should be shared within professional learning communities to consistently collect, and analyze data but also to allow professionals to discuss teaching and learning strategies that further develop from student discussions and qualitative data.

Awareness of students' self-concept of ability in mathematics would support specific self-concept teacher/classroom interventions to be put into place to support the development of students' positive self-concept in mathematics. Continued awareness will not only allow for continued monitoring of students' self-concept of ability in mathematics but also allow teachers to reflect on teaching and learning practices recognized by students as being helpful in their development of a positive self-concept of ability in math. It would be beneficial for teachers and schools to develop advocacy systems to evaluate and support students' self-concept of ability in mathematics to specifically focus on the improvement of the stage-environment fit, which students recognize as lacking in their math learning environments.

With the implementation of the proposed interventions in the area of academic press, feedback and reinforcement, social supports, and modifications to the learning environment, it is suggested that students' self-concept of ability in mathematics be assessed regularly and frequently to determine the overall effectiveness of the changes on each student. As learned from this study, the utilization of a Likert scale gives an overview of students' self-concept, however, to access an in depth review of students' self-concept the collection of qualitative data provides the best insight into the perceptions of students.

By listening to the voices of students, stakeholders can address the individual needs of the middle school learner and make changes to the mathematical learning environment that not only support the enhancement of math skills but also support the development of positive self-concepts of ability in mathematics. In conjunction with practices focused on the development of positive self-concept and positive mathematical dispositions in middle school students, the implementation of teaching and learning practices to enhance the development of positive self-concept of students would provide a basis and model for middle school programs in evaluating and supporting students' positive mathematical dispositions prior to entering high school. In essence, the development of middle school programs focused on students' positive self-concept of ability in mathematics helps to set the stage for STEM course selection and career choices in high school and beyond.

Recommendations for Future Research

The parameters defined in the purposeful sampling of this study were intentionally imposed to limit the scope of the research and focus on the transferability of the findings. Future studies should consider widening the scope of the study by choosing alternative settings, broadening the variability in the school demographics, or expanding the sampling. As noted earlier, the intention of this preliminary mixed methods research was not to make generalizations in research but to add to current research and offer the transfer of ideas to other settings.

Researchers may want to study the existence of relationships amongst the proposed interventions. Neither the correlation amongst interventions nor correlations between interventions and self-concept were studied within this research. Such studies could support the combination of interventions to support positive growth in students' self-concept in mathematics.

A final recommendation for future studies is to research the impact a systematic self-concept program has on a student's positive mathematical disposition. As noted, the middle school student's self-concept in all domains is described as a fluctuating construct. It may be of interest for future researchers to examine how a program that consistently assesses the self-concept of students and adjusts interventions based on a student's self-concept, impacts a student's self-concept, attitude and/or positive mathematical disposition.

In all recommendations proposed here, a longitudinal study would look for consistencies that occur throughout the schooling of the students. Understanding when and where fluctuations occur, how students' self-concept of ability in mathematics is impact and what interventions prove to support the development of a positive self-concept of students' throughout their schooling would add to literature and additionally add to the current research. The more researchers focus on the development of students' positive self-concept of ability in mathematics, the more stakeholders can hope for an increase in student interest in STEM careers and more positive feelings toward mathematics.

Conclusion

Self-concept has an important effect on the way students "feel about themselves, their accomplishments, persistence and educational decisions" (Möller et al., 2009, p. 1130). By studying the self-concept of students, researchers can help stakeholders to develop a deeper understanding of the academic domain, the middle school learner and the development of one's positive mathematical disposition. This case study of middle school eighth-grade math students is a provision of the middle school student perspective as to what classroom interventions support the development of a positive self-concept in mathematics.

Parker (2010) acknowledged how critical it is for middle school educators to be aware of young adolescents' perceptions of self based on the constant fluctuation of a middle school student's self-concept of ability in mathematics. The purpose is not to make a prediction of future achievement but to implement classroom and teacher practices that support the development of a students' positive self-concept of ability in mathematics. While the proposed interventions may not positively impact the mathematical disposition of all students, middle school is described as a poignant period in the development of a student's negativity towards mathematics, underscoring recommendations to change the mathematical learning paradigm.

Self-concept is malleable and is positively correlated to student achievement. Ajzen's Theory of Planned Behavior supports the malleability of a student's mathematical disposition with the idea that as long as a student's attitude/behavior towards mathematics is accepted as such (i.e. a negative disposition), then it will remain unchanged. Moreover, if a student's negative attitude or negative self-concept is not accepted and interventions are put into place, then there is the chance for a transformation of a negative self-concept to one that is positive.

Students answered questions about what teachers can do for positive change in self-concept and their mathematical learning environments. Students have clearly identified the importance of a classroom environment that matches their needs for social interaction and academic press to best support their self-concept development. Students are asking for more than “good” grades to show their levels of competency. It is the responsibility of teachers and stakeholders to implement the proposed practices in the math classrooms to ensure mathematical learning environments that go beyond the scope of skills enhancement and address the affective needs of our learners. There is challenging work to be done to change the teaching and learning practices of mathematics to better the negative mathematical disposition of math students beyond the teaching or re-teaching of math skills. The self-concept of mathematical learners about their ability is a key construct in the development of their future success.

Students identify mathematics and achievement in mathematics as a doorway to the future. Whether a student is interested in pursuing a STEM career, they recognize the value of having good grades in mathematics to get into college or to obtain a successful career. The value of mathematics expands beyond learning the skill. The vision students have for mathematics is not necessarily based on its application, although many recognize personal reasons for its use. Math is a stepping stone on their educational journey, whether they expect to choose a career in the STEM fields. It is the role of the transformative leaders to ensure the doorway is open for students by supporting positive change in mathematical disposition and achievement via students’ self-concept of ability in mathematics; an extension beyond the enhancement of math skills and general self-concept of ability.

REFERENCES

Aiken, L. R. (1970). Attitudes Toward Mathematics. *Review of Educational Research, 40*(4), 551– 596. doi:10.3102/00346543040004551

Andersen, L. & Cross, T. L. (2014) Are Students With High Ability in Math More Motivated in Math and Science Than Other Students?, *Roeper Review*, *36*(4), 221-234, doi: 10.1080/02783193.2014.945221

Arens, A. K., Yeung, A.S., Craven, R. G., & Hasselhorn, M. (2011). The twofold multidimensionality of self-concept: Domain specificity and separation between competence and affect components. *Journal of Educational Psychology*, *103*(4), 970-981. doi: 10/1037/a002504

Ashcraft, M. H., & Krause, J. A. (2007). Working memory, math performance, and math anxiety. *Psychonomic Bulletin & Review*, *14*(2), 243-248.

Attard, C. (2013). “If I had to pick any subject, it wouldn’t be maths”: Foundations for engagement with mathematics during the middle years. *Mathematics Education Research Journal*, *25*(4), 569–587. doi:10.1007/s13394-013-0081-8

Awad, G. H. (2007). The role of racial identity, academic self-concept and self-esteem in the prediction of academic outcomes for African American students. *Journal of Black Psychology*, *33*(2), doi:10.1177/0095798407299513

Baldwin, S. A., & Hoffmann, J. P. (2002). The dynamics of self-esteem: A growth-curve analysis. *Journal of Youth and Adolescence, 31*, 101–113.

Bandura, A. (2006). Adolescent development from an agentic perspective. *Self-efficacy beliefs of adolescents*, *5*(1-43).

Barth, J. M., Todd, B., McCallum, D. M., Goldston, M., Guadagno, R.E., Roskos, B., &

Burkhalter, C. (2011). Effects of engaging classroom strategies and teacher support on student outcomes over school transitions. *Proceedings of the American Society for Engineering Education*, 2011. Retrieved from: www.asee.org/public/conferences/1/papers/2446/view

Beyers, J. (2011). Student dispositions with respect to mathematics: What current literature says. In D. J. Barhier & W. R. Speer (Eds.), *Motivation and disposition: Pathways to learning mathematics* (pp. 69-80). Reston, VA: The National Council of Teachers of Mathematics.

Bicknell, B., & Riley, T. (2012). Investigating transitions in mathematics from multiple perspectives. *Mathematics Education Research Journal*, *24*(1), 1–17. doi:10.1007/s13394-011-0027-y

Bleeker, M. M., & Jacobs, J. E. (2004). Achievement in math and science: do mothers' beliefs matter 12 years later? *Journal of Educational Psychology*, *96*(1), 97–109. doi: 10.1037/0022-0663.96.1.97

Bloomberg, L. D. & Volpe, M. (2012). *Completing your qualitative dissertation: A road map from beginning to end*. Sage Publications.

Bobis, J., Anderson, J., Martin, A., & Way, J. (2011). A model for mathematics instruction to enhance student motivation and engagement. In D. J. Barhier & W. R. Speer (Eds.), *Motivation and disposition: Pathways to learning mathematics* (pp. 31-42). Reston, VA: The National Council of Teachers of Mathematics.

Bong, M., & Skaalvik, E. M. (2003). Academic self-concept and self-efficacy: How different are they really? *Educational Psychology Review*, *15*(1), 1–40.

Booth, M. Z., & Gerard, J. M. (2012). Adolescents' stage-environment fit in middle and high school: the relationship between students' perceptions of their schools and themselves.

Youth & Society, 46(6), 735-755. doi:10.1177/0044118X12451276

Bouhlila, D. S. (2011). The quality of secondary education in the Middle East and North Africa: what can we learn from TIMSS' results? *Compare: A Journal of Comparative and International Education*, *41*(3), 327–352. doi: 10.1080/03057925.2010.539887

Byrne, B. M. (1996). *Measuring self-concept across the life span: Issues and instrumentation*. Washington, D.C.: American Psychological Association.

Caskey, M.M. (2010). A Longitudinal Investigation of Young Adolescents' Self-Concepts in the Middle Grades. *RMLE Online: Research in Middle Level Education*, *33*(10).

Chen, S. K., Hwang, F. M., Yeh, Y. C., & Lin, S. S. J. (2012). Cognitive ability, academic achievement and academic self-concept: Extending the internal/external frame of reference model. *British Journal of Educational Psychology*, *82*(2), 308–326. doi:10.1111/j.2044-8279.2011.02027.x

Choi K., Choi, T., & McAninch, M. (2012). A comparative investigation of the presence of psychological conditions in high achieving eighth graders from TIMSS 2007 Mathematics. *ZDM Mathematics Education, 44*, 189-199. doi: 10.1007/s11858-012-0401-6

Cokley, K., & Moore, P. (2007). Moderating and mediating effects of gender and psychological disengagement on the academic achievement of African American college students. *Journal of Black Psychology*, *33*(2), 169-187. doi: 10.1177/0095798407299512

Coghlan, D. & Brannick, T. (2014). *Doing action research in your own organization (4th ed).* Thousand Oaks, CA: SAGE Publications.

Cotton, K. (1995). *Effective schooling practices: A research synthesis, 1995 update*. Portland, OR: Northwest Regional Educational Laboratory.

Creswell, J. (2013). *Qualitative inquiry and research design: Choosing among five approaches*. Thousand Oaks, CA: Sage Publications.

Daskalogianni, K., & Simpson, A. (2000). Towards a definition of attitude: The relationship between the affective and the cognitive in pre-university. Proceedings of *PME Conference, 24*(2), 2-217.

Di Martino, P. & Zan, R. (2003). What does "positive" attitude really mean? *International Group of Psychology of Mathematics Education*. *4*, 451-458.

Di Martino, P. & Zan, R. (2010). 'Me and maths': towards a definition of attitude grounded on student narratives. *Journal of Mathematics Teacher Education*, *13*(1), 27-48.

Di Martino, P. & Zan, R. (2011). Attitude towards mathematics: a bridge between beliefs and emotions. *Mathematics Education*, *43*, 471-482.

Dweck, C. (2006). Mindset: The new psychology of success. Random House.

Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., & Meece, J. L. (1983). Expectations, values, and academic behaviors. In J. T. Spence (Ed.), *Perspective on achievement and achievement motivation* (pp. 75–146). San Francisco, CA: Freeman.

Eccles, J. S., & Midgley, C. (1989). Stage-environment fit: Developmentally appropriate classrooms for young adolescents. In R. E. & C. A. Ames (Eds.), *Research on motivation in education* (Vol. 3, pp. 139–186). New York: Academic Press.

Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., & Mac Iver, D. (1993). Development during adolescence: The impact of stage-environment fit on young adolescents' experiences in schools and in families. *American Psychologist*, *48*(2), 90-101. doi:10.1037/0003-066X.48.2.90

Eccles, J. S., & Wigfield, A. (1995). In the mind of the achiever: The structure of adolescents' academic achievement related-beliefs and self-perceptions. *Personality and Social Psychology Bulletin*, *21*, 215–225.

Eccles, J. S., Wigfield, A., Flanagan, C. A., Miller, C., Reuman, D. A., & Yee, D. (1989). Self-concepts, domain values and self-esteem: Relationships and changes at early adolescence. *Journal of Personality, 57*(2), 283–310.

Else-Quest, N. M., Mineo, C. C., & Higgins, A. (2013). Math and science attitudes and achievement at the intersection of gender and ethnicity. *Psychology of Women Quarterly, 37*(3), 293–309. doi:10.1177/0361684313480694

Fink, L. L. (2010). *A comparison of grade configuration on urban sixth to eighth grade student outcomes in regular and special education* (Doctoral dissertation). Available from ProQuest Dissertations & Theses A&I. (762381225). Retrieved from http://search.proquest.com/docview/762381225?accountid=12756

Goe, L. & Stickler, L. M. (2008). Teacher quality and student achievement: Making the most of recent research. TQ Research & Policy Brief. *National Comprehensive Center for Teacher Quality*.

Gottfried, A. E., Marcoulides, G. A., Gottfried, A. W., & Oliver, P. H. (2013). Longitudinal pathways from math intrinsic motivation and achievement to math course accomplishments and educational attainment. *Journal of Research on Educational Effectiveness, 6*(1), 68-92. doi: 10.1080/19345747.2012.698376

Green, J., Nelson, G., Martin, A. J., and Marsh, H. W. (2006). The causal ordering of self-concept and academic motivation and its effect on academic achievement. *International Education Journal*, *7*(4), 524-546

Guay, F., Larose, S., & Boivin, M. (2004) Academic self-concept and educational attainment level: a ten-year longitudinal study. *Self and Identity*, *3*(1), 53-68. doi: 10.1080/13576500342000040

Guay, F., Marsh, H. W. & Boivin, M. (2003). Academic self-concept and academic achievement: developmental perspectives on their causal ordering. *Journal of Educational Psychology*, *95*(1), 124-136. doi: 10.1037/0022-0663.95.1.124

Hannula, M. S. (2002). Attitude towards mathematics: Emotions, expectations and values. *Educational Studies in Mathematics*, *49*(1), 25-46.

Hart, L. E. (1989). Describing the affective domain: Saying what we mean. In *Affect and mathematical problem solving* (pp. 37-45). Springer New York.

Hassan, N., Ching, K. Y., & Hamizah, N. N. (2012). Gifted students' affinity towards mathematics. *Advances in Natural & Applied Sciences*, *6*(8), 1219–1222. 4p. 3 Charts. Retrieved from: http://www.researchgate.net/publication/235631140_Factors_That_Influence_Gifted_Students_Attitude_against_Mathematics

Hein, S., & Austin, W. (2001). Empirical and hermeneutic approaches to phenomenological research in psychology: A comparison. *Psychological Methods*, *6*(1), 3-17. doi:10.1037//1082-989x.6.1.3

Hemmings, B., Grootenboer, P. & Kay, R. (2010). Predicting mathematics achievement: The influence of prior achievement and attitudes. *International Journal of Science and Mathematics Education*, *9*, 691-705.

Hergovich, A., Sirsch, U., & Felinger, M. (2004). Gender differences in the self-concept of preadolescent children. *School Psychology International*, 25(2), 207–222. doi: 10.1177/0143034304043688

Hodkinson, P., Biesta, G., & James, D. (2008). Understanding learning culturally: Overcoming the dualism between social and individual views of learning. *Vocations and Learning*, *1*(1), 27-47.

Huang, C. (2011). Self-concept and academic achievement: A meta-analysis of longitudinal relations. *Journal of School Psychology*, *49*(5), 505-528.

Hunt, D. E. (1975). Person-environment interaction: A challenge found wanting before it was tried. *Review of Educational Research*, *45*, 209-230.

Jones, M. H., Irvin, M. J., & Kibe, G. W. (2012). Does geographic setting alter the roles of academically supportive factors? African American adolescents' friendships, math self-concept, and math performance. *Journal of Negro Education*, *81*(4), 319–337. Retrieved from http://search.proquest.com/docview/1319838901?accountid=12756

Kalder, R. S., & Lesik, S. A. (2011). A classification of attitudes and beliefs towards mathematics for secondary mathematics pre-service teachers and elementary pre-service teachers: An exploratory study using latent class analysis. *Issues in the Undergraduate Mathematics Preparation of School Teachers*, *5*, 1-20. Retrieved from http://www.k-12prep.math.ttu.edu/journal/5.attributes/volume.shtml

Köğce, D., Yıldız, C., Aydın, M., & Altındağ, R. (2009). *Examining elementary school students' attitudes towards mathematics in terms of some variables*. Procedia-Social and Behavioral Sciences, *1*(1), 291-295.

Kulm, G. (1980). Research on mathematics attitude. In R.J. Shumway (Ed.). *Research in Mathematics Education*, (p. 356-387). Reston, VA: NCTM.

Laerd Statistics: types of variable (2013). Retrieved from https://statistics.laerd.com/statistical-guides/types-of-variable.php

Lazarides, R., & Watt, H. M. (2015). Girls' and boys' perceived mathematics teacher beliefs, classroom learning environments and mathematical career intentions. *Contemporary Educational Psychology*, *41*, 51-61.

Lee, J., & Shute, V. J. (2010). Personal and social-contextual factors in K–12 academic performance: An integrative perspective on student learning. *Educational Psychologist*, *45*(3), 185-202.

Liem, G.A., Marsh, H.W., Martin, A.J., McInerney, D.M., & Yeung, A.S. (2013). The big-fish-little-pond effect and a national policy of within-school ability streaming: Alternative frames of reference. *American Educational Research Journal*, *50*(2), 326-370. Doi: DOI: 10.3102/0002831212464511

Lipnevich, A. A, MacCann, C., Krumm, S., Burrus, J., & Roberts, R. D. (2011). Mathematics attitudes and mathematics outcomes of U.S. and Belarusian middle school students. *Journal of Educational Psychology, 103*(1), 105–118. doi:10.1037/a0021949

Ma, X., & Kishor, N. (1997). Assessing the relationship between attitude toward mathematics and achievement in mathematics: A meta-analysis. *Journal for Research in Mathematics education*, *28*(1), 26-47. doi:10.2307/749662

Ma, X., & Xu, J. (2004). Determining the causal ordering between attitude toward mathematics and achievement in mathematics. *American Journal of Education*, 110(3), 256-280.

Marsh, H. W. (1986). Verbal and math self-concepts: An internal/external frame of reference model. *American Educational Research Journal*, *38*, 299-337.

Marsh, H. W. (1990). The structure of academic self-concept: The Marsh/Shavelson model. *Journal of Educational Psychology*, *82*, 623-636.

Marsh, H. W. (1992). Content specificity of relations between academic achievement and academic self- concept. *Journal of Educational Psychology, 84*, 35-42.

Marsh, H. W., Abduljabbar, A. S., Parker, P., Morin, A. J., Abdelfattah, F., Nagengast, B., & Abu-Hilal, M. (2015). The big-fish-little-pond effect: Generalizability of social comparison processes over two age cohorts from western, Asian, and middle eastern Islamic countries. *Journal of Educational Psychology, 101*(1), 258-272. doi:10.1037/a0037485

Marsh, H. W., & Craven, R. G. (2006). Reciprocal effects of self-concept and performance from a multidimensional perspective: Beyond seductive pleasure and unidimensional perspectives. *Perspectives of Psychological Science*, *1*(2), 133-163.

Marsh, H. W., & Shavelson, R. J. (1985). Self-concept: Its multifaceted, hierarchical structure. *Educational Psychologist*, *20*, 107-125.

Marsh, H.W., Smith, I. D., Barnes, J., & Bustler, S. (1983). Self-concept: Reliability, stability, dimensionality, validity, and the measurement of change. *Journal of Educational Psychology, 75*(5), 772-790. doi:10.1037/0022-0663.75.5.772

Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2005). Academic self-concept, interest, grades, and standardized test scores: Reciprocal effects models of causal ordering. *Child Development*, *76*(2), 397–416. doi:10.1111/j.1467-8624.2005.00853.

Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2006). Integration of Multidimensional Self-Concept and Core Personality Constructs: Construct Validation and Relations to Well-Being and Achievement. Journal of personality, *74*(2), 403-456.

Marsh, H. W., & Yeung, A.S. (1997). Coursework selection: relations to academic self-concept and achievement. *American Educational Research Journal*, *34*(4), 691-720.

Matovu, M. (2014). A structural equation modeling of the academic self-concept scale. *International Electronic Journal of Elementary Education*, *6*(2), 185-198.

McInerney, D. M., Cheng, R. W., Mok, M. M. C., & Lam, A. K. H. (2012). Academic self-concept and learning strategies: Direction of effect on student academic achievement. *Journal of Advanced Academics*, *23*(3), 249–269. doi: 10.1177/1932202X12451020

McLeod, D. B. (1992). Research on affect in mathematics education: A reconceptualization. *Handbook of research on mathematics teaching and learning*, 575-596.

Merriam, S.B. (2009). *Qualitative research: A guide to design and implementation*. Hoboken, NH: Jossey-Bass Publications.

Methe, S. A., & Riley-Tillman, T. C. (2008). An informed approach to selecting and designing early mathematics interventions. *School Psychology Forum: Research into Practice*, *2*, 29-41.

Möller, J., Pohlmann, B., Köller, O., & Marsh, H. W. (2009). A meta-analytic path analysis of the internal/external frame of reference model of academic achievement and academic self-concept. *Review of Educational Research*, *79*(3), 1129–1167. doi:10.3102/0034654309337522

Murphy, J. F., Weil, M., Hallinger, P., & Mitman, A. (1982). Academic press: Translating high expectations into school policies and classroom practices. *Educational Leadership*, *40*(3), 22-26.

Nadler, D. A. (2006). The congruence model of change. In J.V. Gallos (Ed). *Organization development* (pp. 252-262). San Francisco: Jossey-Bass.

Nagy, G., Trautwein, U., Baumert, J., Köller, O., & Garrett, J. (2006). Gender and course selection in upper secondary education: Effects of academic self-concept and intrinsic value. *Educational Research and Evaluation, 12*(4), 323-345.

National Council of Teachers of Mathematics (1989). *Curriculum and Evaluation Standards for School Mathematics*. Reston, VA: NCTM.

National Mathematics Advisory Panel. (2008). Foundations for success: The final report of the National Mathematics Advisory Panel. Washington, DC: U.S. Department of Education.

Neale, D. C. (1969). The role of attitudes in learning mathematics. *The Arithmetic Teacher, 16*(8), 631-640.

Nicholaidou, M., & Philippou, G. (2003). *Attitudes towards mathematics, self-efficacy and achievement in problem solving*. European Research in Mathematics Education III. Pisa: University of Pisa.

O'Mara, A. J., Marsh, H. W., Craven, R. G, & Debus, R. L. (2006) Do self-concept interventions make a difference? A synergistic blend of construct validation and meta-analysis. *Educational Psychologist, 4*(3), 181-206. doi: 10.1207/s15326985ep4103_4

Ontario Principal's Council (2008). *The principal as mathematics leader*. Corwin Press.

Palincsar, A. S. (2005). 12 Social constructivist perspectives on teaching and learning. An introduction to Vygotsky, 285.

Parker, A. K. (2010). A longitudinal investigation of young adolescents' self-concepts in the middle grades. *RMLE Online: Research in Middle Level Education*, *33*(10), 1–13.

Philipp, R. A. (2007). Mathematics teachers' beliefs and affect. In F. K. Lester (Ed.), *Second handbook of research on mathematics teaching and learning* (Vol. 1). USA: National Council of Teachers of Mathematics.

Pietsch, J., Walker, R., & Chapman, E. (2003). The relationship among self-concept, self-efficacy, and performance in mathematics during secondary school. *Journal of Educational Psychology*, *95*(3), 589.

Pinxten, M., De Fraine, B., Van Damme, J., & D'Haenens, E. (2013). Student achievement and academic self-concept among secondary students in Flanders: Gender and changes over time. *Irish Educational Studies*, *32*(2), 157-178 doi: 10.1080/03323315.2012.749058

Plante, I., O'Keefe, P. A., & Théorêt, M. (2013). The relation between achievement goal and expectancy-value theories in predicting achievement-related outcomes: A test of four theoretical conceptions. *Motivation and Emotion*, *37*(1), 65-78.

Preckel, F., Gotz, T., & Frenzel, A. (2010). Ability grouping of gifted students: Effects on academic self-concept and boredom. *British Journal of Educational Psychology*, *80*(3), 451–472.

President's Council of Advisors on Science and Technology (2010, September). Prepare and inspire: K-12 education in science, technology, engineering, and math (STEM) for American's future. Retrieved from: https://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stemed-report.pdf

Reyes, L. H. (1984b). Affective variables and mathematics education. *The Elementary School Journal*, *84*(5), 558–581. Retrieved from http://www.jstor.org/stable/10.2307/1001237

Rice, L., Barth, J. M., Guadagno, R. E., Smith, G. P. A., & McCallum, D. M. (2013). The role of social support in students' perceived abilities and attitudes toward math and science. *Journal of Youth and Adolescence*, *42*(7), 1028–1040. doi: 10.1177/1932202X14536566

Riegle-Crumb, C., Moore, C., & Ramos-Wada, A. (2011). Who wants to have a career in science or math? Exploring adolescents' future aspirations by gender and race/ethnicity. *Science Education*, *95*(3), 458–476. doi: 0.1002/sce.20431

Rockoff, J., & Lockwood, B. (2010). Stuck in the middle: Impacts of grade configuration in public schools. *Journal of Public Economics, 94*(2), 1051-1061.

Rothwell, J. (2014). Still searching: job vacancies and STEM skills. *Brookings*. Washington, DC.

Saldaña, J. (2015). The Coding Manual for Qualitative Researchers. Los Angeles, CA: SAGE.

Schwerdt, G., & West, M. R. (2013). The impact of alternative grade configurations on student outcomes through middle and high school. *Journal of Public Economics, 97*, 308-326.

Seaton, M., Parker, Marsh, H.W., Craven, R.G., & Yeung, A.S. (2014). The reciprocal relations between self-concept, motivation and achievement: Juxtaposing academic self-concept and achievement goal orientations for mathematics success. *Educational Psychologist, 34*(1), 49–72. doi: 10.100/01443410.2013.835232

Seidman, I. (2013*). Interviewing as qualitative research: A guide for researchers in education and social sciences*. New York, NY: Teachers College Press.

Seidman, E., Allen, L., Aber, J. L., Mitchell, C., & Feinman, J. (1994). The impact of school transitions in early adolescence on the self- system and perceived social context of poor, urban youth. *Child Development, 65*(2), 507–522.

Shavelson, R. J., Hubner, J. J., & Stanton, G. C. (1976). Self-concept: Validation of construct interpretations. *Review of Educational Research*, *46*, 407-444.

Skaalvik, E. M., & Skaalvik, S. (2002). Internal and external frames of reference for academic self-concept. *Educational Psychologist, 37*(4), 233-244.

Tapia, M., & Marsh, G. E. (2005). Attitudes toward mathematics inventory redux. *Academic Exchange Quarterly*, *9*(3), 272-277.

United States Department of Education (2014). *Science, technology, engineering and math: Education for global leadership.* Retrieved from http://www.ed.gov/stem

United States Census Bureau (2014). Census bureau reports majority of STEM college graduates do not work in STEM occupations (Release No. CB14-130) Retrieved from http://www.census.gov/newsroom/press-releases/2014/cb14-130.html

Valentine, J., Dubois, D. L., & Cooper, H. (2004). The relation between self-beliefs and academic achievement: A meta-analytic review. *Educational Psychologist*, *39*(2), 111–133. doi:10.1207/s15326985ep3902_3

Wang, Z., Osterlind, S. J., & Bergin, D. A. (2012). Building mathematics achievement models in four countries using TIMSS 2003. *International Journal of Science and Mathematics Education, 10*(5), 1215–1242. doi: 10.1007/s10763-011-9328-6

Watt, H. M. (2004). Development of adolescents' self-perceptions, values, and task perceptions according to gender and domain in 7th through 11th grade Australian students. *Child development*, *75*(5), 1556-1574. doi: 10.1111/j.1467-8624.2004.00757.x

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology, 25*(3 & 4), 68-81.

Wigfield, A., & Karpathian, M. (1991). Who am I and what can I do? Children’s self-concepts and motivation in achievement situations. *Educational Psychologist*, *26*(3 & 4), 233-261.

Wilkins, J. L. M. (2004). Mathematics and science self-concept: An international investigation. *The Journal of Experimental Education*, *72*(4), 331–346. doi: 10.3200/JEXE.72.4.331-346

Willingham, D. T. (2009). *Why don't students like school: A cognitive scientist answers questions about how the mind works and what it means for the classroom*. San Francisco, CA: Jossey-Bass.

Winheller, S., Hattie, J. A., & Brown, G. T. (2013). Factors influencing early adolescents’ mathematics achievement: High-quality teaching rather than relationships. *Learning Environments Research*, *16*(1), 49-69. doi: 10.1007/s10984-012-9106-6

Yilmaz, C., Altun, S. A. & Ollkun, S. (2010). Factors affecting students' attitude towards math: ABC theory and its reflection on practice. *Procedia Social Science and Behavioural Sciences*, *2*(2), 4502-4506. doi: 10.1016/j.sbspro.2010.03.720

Yoshino, A. (2012). The relationship between self-concept and achievement in TIMSS 2007: A comparison between American and Japanese students. *International Review of Education*, *58*(2), 199–219. doi: 10.1007/s11159-012-9283-7

Zanobini, M., & Usai, M. C. (2002). Domain-specific self-concept and achievement motivation in the transition from primary to low middle school. *Educational Psychology, 22*(2), 204–217.

Zollman, A., Smith, M. C., & Reisdorf, P. (2011). Identity development: Critical component for learning in mathematics. In D. J. Barhier & W. R. Speer (Eds.), Motivation and disposition: Pathways to learning mathematics (pp. 43-54). Reston, VA: The National Council of Teachers of Mathematics.

APPENDIX A: ONLINE SURVEY

Introduction

The goal of this survey is to get your perspective of math and what helps you to be successful as a math student. If you are reading this then:

- Your parent/guardian has given you permission to participate in this study AND
- You have agreed to participate.

As you are completing the survey, here are a few reminders:

- You may choose to opt out of the study at any time and for any reason.
- Everything you write will be kept confidential and anonymous.
- Nobody else will read your responses except for me. It will not be shared with any of your teachers, parents or friends.
- Nothing you submit will be graded, or count towards your school grades. In fact, there are no right or wrong answers. ☺
- Please write freely to express yourself. The more detail you write and the more you express yourself the more helpful it will be to my research.

Survey Components:

Name
Age
Male or Female
Algebra or 8th Grade Math or Other

Rank the following statements according to the scale provided.

1 – Definitely False
2 – Mostly False
3 – False
4 – More False than True
5 – More True than False
6 – Mostly True
7 – True
8 – Definitely True

a. I learn things quickly in math class.
b. I am hopeless when it comes to math classes

c. I have always done well in math classes
d. Compared to others my age I am good at math classes
e. Work in math classes is easy for me
f. I get good marks in math classes
g. It is important for me to do well in math classes
h. I a satisfied on how well I do in math classes

2. Read each sentence. Consider how each experience has made you feel towards mathematics and your abilities in mathematics.

1 – Definitely Negative
2 – Mostly Negative
3 – Mostly Positive
4 – Definitely Positive
5 – I have not experienced this

Classroom Management and Organization

a. The teacher teaches a lesson to the entire class when introducing a new math concept or skill
b. The teacher puts me in a group based on my abilities in math.
c. The teacher checks on my group a lot to make sure we understand the math content.
d. The teacher moves me to a high level group when I understand the topic.
e. Form small groups for instruction and practice in the use of higher-order thinking skills.
f. The teacher puts me in a group and promises us a reward if our group is successful.
g. The teacher puts me in a group and tells me I am responsible for my own work.
h. The teacher assigns students in the class to help and tutor me during the class period.
i. The teacher makes sure that the group I am in has both boys and girls in it.
j. Give an example of group work that left feeling really positive or really negative towards math.
k. Use this area to provide any information on group work that has helped you have a positive or negative outlook towards math.

Instruction

a. The teacher gives me immediate feedback on my written assignments to help me understand and correct errors.
b. The teacher lets me know when I am correct during class discussions, group work, on tests and on assignments.
c. The teacher gives me specific feedback related to the unit goals or overall math goals.
d. The teacher praised me for correct answers and for growth in relation to past my past math performance.
e. The teacher gives me feedback in math based on evaluations my peers have completed.
f. I am assigned math activities on the computer that give students immediate feedback regarding their learning performance.
g. The teacher assigns math homework regularly.
h. My math homework gets corrected and returned quickly.
i. My classmates give me feedback and reinforcement when they are helping or tutoring me.
j. Describe a situation in math where the feedback made you feel positive or negative towards math.
k. Use this area to provide any information on feedback that has helped you have a positive or negative outlook towards math.

<u>Teacher-Student Interactions</u>

a. The teacher has set high standards for learning and lets me know I am expected to meet them.
b. The teacher lets me know that standards are both challenging and achievable.
c. The teacher expects me to perform at a level needed to be successful the high school.
d. The teacher does not expect me to fail.
e. The teacher holds me accountable for completing assignments, turning in work, and participating in classroom discussions.
f. The teacher provides time, and instruction necessary to help me perform at acceptable levels.
g. The teacher gives me different learning materials just as interesting as materials provided to other students.
h. The teacher encourages me to perform at an eighth-grade level.
i. The teacher has his/her own opinion of me and doesn't listen to others' opinions of me.
j. The teacher emphasizes that different students are good at different things and reinforces this by asking me to look at other students work.
k. Give an example where the teacher had high-expectations of you and this made you feel really good about math or really bad about math.
l. Use this area to provide any information related to the high-expectations that has helped you have a positive or negative outlook towards math.

<u>Teacher-Student Interactions</u>

a. The teacher pays attention to my social interests, activities and problems.
b. The teacher encourages me to give math my best effort, focuses on positive aspects of my answers, products, and behavior.
c. The teacher communicates his/her interest and care for me, verbally and non-verbally (such as giving me undivided attention, maintaining eye contact, smiling, or nodding).
d. The teacher encourages me to develop a sense of responsibility for school-related activities and to participate in making decisions about important school issues.
e. The teacher shares stories from his/her life with me.
f. Write about an interaction between you and your math teacher that made you feel positive or negative towards math.
g. Use this area to provide any information related to your interactions with math teachers that has helped you have a positive or negative outlook towards math.

<u>Equity</u>

a. The teacher keeps track of my learning and knows when I am having trouble in math;
b. The teacher makes notes on what I am struggling in and arrange for me to get help.
c. The teacher communicates high learning and behavioral expectations to students and holds them accountable for meeting classroom standards.
d. The teacher provides me with instructions on how to study and strategies used by successful students.
e. The teacher gives me additional learning time whenever possible. This includes spending extra time.
f. Describe a situation in math class where you used extra time and help and how this made you feel towards math.
g. Use this area to provide any information related to extra time or extra help that has helped

you have a positive or negative outlook towards math.

APPENDIX B: INFORMED CONSENT/ASSENT FOR PARTICIPATION IN RESEARCH

Dear Parent/Guardian,

My purpose in writing to you today is to ask you to consider allowing your child to participate in a research case study that I will be conducting at your child's school. This study is being conducted under the guidance of faculty from the University of New England in Maine where I am enrolled as a doctoral candidate in educational leadership. I'd like to tell you about the study and allow you to think about whether you wish your child to participate or not. Please understand that you are under no obligation to grant permission for your child to participate.

The study focuses on the middle school students' perspectives and the importance of self-concept in supporting math students' mathematical dispositions. Selected students will complete an online survey, and a face-to-face interview to share thoughts about mathematics.

Online Survey: The survey link will be provided to students to write during the month of November to complete at their leisure. The survey questions are a combination of rankings and open-response. Survey information will be coded to ensure that not identifiable student information is contained.

Interview: The interview will take approximately 60 minutes and will be scheduled during a convenient time and location for the student. The interview will take place after the completion of submission of the online survey. Students may volunteer to participate in a follow-up individual interview. Student interviews will be recorded, transcribed and coded to ensure that no identifiable student information is contained.

The results will add to the field of research in understanding the student's self-concept as it relates to math achievement, attitude and mathematical disposition during middle school years**.**

My hope in conducting this study is to honor the perspective of students as sources of information about self-concept of ability in mathematics and teacher/classroom interventions that have an impact on their self-concept of ability. I believe there a great deal to be learned from the perspective of the student. Research supports this belief, however, there are gaps in research to utilizing the student voice to as it pertains to math self-concept during the middle school years.

Benefits

The findings from this study will enable teachers, and those involved with math education, to plan math interventions to support the middle level learner. Such planning supports positive growth in math self-concept of ability, attitudes towards math and math achievement of students.

Withdrawal

As the parent/guardian, you are free to withdraw your consent at any point and for any reason during the study. Your student may also discontinue participation in this study at any time for any reason. Withdrawal will not have any risks to you or your student at Hollis Brookline Middle School.

Risks and Hazards
There are no known risks in participating in this survey. Your student's participation will contribute to a study, which will bring knowledge to the field of mathematics education.

Participant Rights and Confidentiality
Your student's name, school name, and all identifying information will be removed, in accordance with Federal Laws surrounding student records. No individually identifiable information will be published. The report from this study will be included in my dissertation as case studies with pseudonyms used.

The interview will be recorded. The recordings will be transcribed as part of the data analysis. Notes may also be taken during the interviews. Completed surveys, recordings, transcriptions, and any notes taken from interviews will be locked and only accessible to the researcher and the transcription company hired, if one is used.

School grades will not be impacted by participation. No aspects of the study will be graded nor will they be shared with teachers, administrators or peers.

Questions regarding the rights of research participants may be addressed to Olgun Guvench, Chair of the University of New England Institutional Review Board at 207-221-4171 or irb@une.edu.

Consent
A copy of the signed consent form stored in a secure location for at least three years after the study is complete. The consent forms will not be associated with any data obtained during the project.

Please note that the IRB at the University of New England may request to review research materials.

Cost to Participant
There are no costs for participation in this research.

Contact Information
If you have any questions or concerns about this study, please contact Katrina Hall, the principal researcher, at khall16@une.edu or by phone 603-289-4923.

I hope you will consider the invitation to participate in this study.

If you give permission for your student to participate, please sign and return the attached form to the principal researcher, Katrina Hall.

Parent/Guardian Statement
I understand the above description of the research and the risks and benefits associated with my child's participation as a research subject. I give consent for my child to take part in the research

and do so voluntarily. You will be given a copy of this consent form.

Parent/Guardian Signature Date

Parent/Guardian Printed Name Date

Student Statement
This study has been fully explained to me. I understand what I have to do and agree to participate in the study.

Student Signature Date

Student Printed Name Date

Researcher Statement
The participant named above had sufficient time to consider the information, had an opportunity to ask questions, and voluntarily agreed to be in this study.

Researcher's Signature Date

Researcher's Printed Name Date

APPENDIX C: SEMI-STRUCTURED STUDENT INTERVIEW INSTRUMENT

Name: **Gender:**

Date: **Time:**

Introduction: Interviewer introduces self and explains the interview to the student.

"I am interested in knowing your thoughts and feelings about some of the kinds of school work you do, especially in math. I'll be asking you a series of questions where there are no right or wrong answers. I am really focused on what you personally think and feel as a student. If there is a question you don't want to answer, you don't have to. You can just let me know that you don't want to answer the question. And if you are not sure what I am asking, please feel free to ask me to reword the question. My hope is that you will answer each question openly and honestly so I can really understand how you feel as a student. All of your answers to the questions will remain between you and I so you can feel safe in mentioning the names of others. I won't tell your teachers, parents, friends or anybody else if you mention their names in our conversation. To help me, I am going to record our interview and may take notes here and there. This is just to help me remember what you say. Do you have any questions?"

General

1. What math classes did you take as a 7th grader? What grades did you get in these classes?
2. What math classes are you taking as an eighth grader? What grades have you gotten in these classes?
3. What grades do you tend to get in your other classes?
4. What plans do you have as you enter high school and after graduation?
5. What school activities do you participate in for fun?

Self-Concept

- Suppose an alien landed from another planet and asked you what math was like. What would tell the alien? What words would you use to describe math?
- What is math? Math is….
- I obviously have not been with you for your entire school career. Can you tell me about your math history from as far Kindergarten to this year?
- One of my favorite shows does this thing called Pros and Cons. If you were on the show, what would be the pros and cons of math?
- If I could see inside your brain, what do you think I would find in the "math section?"
- So when I say "worse math experience ever," can you tell me about that experience?
- So when I say "best math experience ever," can you tell me about that experience?

Teacher-Student Interactions **- Personal interactions between teachers and students are positive.**

- There is a superhero comic called "two-face" who has two sides. Think of this as you describe you design "two-face" the teacher. Tell me about the negative aspects that make you feel badly about math and then tell me about the positive aspects of a teacher that make you feel good about math.

<u>Equity</u> **- Students at risk of school failure are given the extra time and help they need to succeed.**

- If you could design a hospital that would make you feel better about math, what would kinds of things would the doctor prescribe? Think of what the doctor might tell you to do, and what the doctor may tell the teacher to do to make your feel better and turn towards success in math.

<u>Classroom Management and Organization -</u> **Instructional groups are formed in the classroom to fit the students' academic and affective needs**

- Tell me how group work functions in math class and what you think about group work.
- If you could give math teachers advice on how to organize math class so all kids like math, what would you say?

<u>Teacher-Student Interactions</u> **- There are high expectations for student learning.**

- If I were to walk into your math class and give you a trophy for meeting the math expectations set in the classroom, what would that mean you achieved?

<u>Instruction</u> **- Students routinely receive feedback and reinforcement regarding their learning progress.**

- Tell me about the kinds of feedback or praise you have gotten in math class and how this impacted your feelings towards math.
- There all kinds of things that make us drive for success. Tell me the kinds of things that make feel successful in math or the kinds of things that make you feel unsuccessful.
- Tell me about a time where you were ripping your hair out, ready to give up and then something happened to change things around for you.

<u>Closing</u>

- Describe the perfect math class where you would feel confident, work your hardest and are most successful.

Ending the Interview

"*That was last interview question. Your answers have been very helpful. Thank you. Is there anything you would like share about your math experience, learning math or math in general that we didn't already talk about? Is there anything you want to add to what you have already shared? Do you have any questions? Thank you again."*

APPENDIX D: ACADEMIC SELF-DESCRPTION QUESTIONAIRRE II

ASDQII♥

INSTRUMENT

All information supplied will be kept strictly confidential								

NAME:	**AGE:**	**(years)**	**(mths)**	**DATE: / /**
MALE / FEMALE (circle one) PROGRAM:				**GROUP:**

PLEASE READ THESE INSTRUCTIONS FIRST
This is not a test - there are no right or wrong answers.

Your answers are confidential and will only be used for research or program development. Your answers will not be used in any way to refer to you as an individual.

This is a chance for you to look at how you think and feel about yourself. It is important that you are honest and that you give your own views about yourself, without talking to others.

On the following pages are a series of statements that are more or less true (or more or less false) descriptions of you. Please use the following eight-point response scale to indicate how true (or false) each item is as a description of you. Respond to the items as you now feel even if you felt differently at some other time in your life. In a few instances, an item may no longer be appropriate to you, though it was at an earlier period of your life (e.g., an item about your present relationship with your parents if they are no longer alive). In such cases, respond to the item as you would have when it was appropriate.

After completing all the items, you will be asked to select those that best describe important aspects – either positive or negative – of how you feel about yourself. Consider this as you are completing the survey.

Use the following eight-point scale to indicate how true (like you) or how false (unlike you), each statement over the page is as a description of you. Please do not leave any statements blank.

1	2	3	4	5	6	7	8
Definitely False	Mostly False	False	More false than true	More true than false	Mostly true	True	Definitely True

Statement		False							True
01.	Compared to others my age I am good at **COMPUTER STUDIES** classes	1	2	3	4	5	6	7	8
02.	I get good marks in **ENGLISH LANGUAGE** classes	1	2	3	4	5	6	7	8
03.	Work in **HISTORY** classes is easy for me	1	2	3	4	5	6	7	8
04.	I am hopeless when it comes to **MATHEMATICS** classes	1	2	3	4	5	6	7	8
05.	I learn things quickly in **P. E. (PHYSICAL EDUCATION)** classes	1	2	3	4	5	6	7	8
06.	I have always done well in **ENGLISH LITERATURE** classes	1	2	3	4	5	6	7	8
07.	Compared to others my age I am good at **ART** classes	1	2	3	4	5	6	7	8
08.	I get good marks in **SCIENCE** classes	1	2	3	4	5	6	7	8
09.	Work in **COMMERCE** classes is easy for me	1	2	3	4	5	6	7	8
10.	I am hopeless when it comes to **MUSIC** classes	1	2	3	4	5	6	7	8
11.	I learn things quickly in **GEOGRAPHY** classes	1	2	3	4	5	6	7	8
12.	Overall I have a lot to be proud of	1	2	3	4	5	6	7	8
13.	I have always done well in **INDUSTRIAL ARTS** classes	1	2	3	4	5	6	7	8
14.	Compared to others my age I am good at **FOREIGN LANGUAGE** classes	1	2	3	4	5	6	7	8
15.	I get good marks in **RELIGIOUS STUDIES**	1	2	3	4	5	6	7	8
16.	Work in **HEALTH** classes is easy for me	1	2	3	4	5	6	7	8
17.	I am hopeless when it comes to most **SCHOOL SUBJECTS**	1	2	3	4	5	6	7	8
18.	I get good marks in **COMPUTER STUDIES** classes	1	2	3	4	5	6	7	8
19.	Work in **ENGLISH LANGUAGE** classes is easy for me	1	2	3	4	5	6	7	8

20.	I am hopeless when it comes to **HISTORY** classes	1	2	3	4	5	6	7	8
21.	I learn things quickly in **MATHEMATICS** classes	1	2	3	4	5	6	7	8
22.	I have always done well in **P. E.** classes	1	2	3	4	5	6	7	8
23.	Compared to others my age I am good at **ENGLISH LITERATURE** classes	1	2	3	4	5	6	7	8
24.	I can do things as well as most people	1	2	3	4	5	6	7	8
25.	I get good marks in **ART** classes	1	2	3	4	5	6	7	8
26.	Work in **SCIENCE** classes is easy for me	1	2	3	4	5	6	7	8
27.	I am hopeless when it comes to **COMMERCE** classes	1	2	3	4	5	6	7	8
28.	I learn things quickly in **MUSIC** classes	1	2	3	4	5	6	7	8
29.	I have always done well in **GEOGRAPHY** classes	1	2	3	4	5	6	7	8
30.	Compared to others my age I am good at **INDUSTRIAL ARTS** classes	1	2	3	4	5	6	7	8
31.	I get good marks in **FOREIGN LANGUAGE** classes	1	2	3	4	5	6	7	8
32.	Work in **RELIGIOUS STUDIES** classes is easy for me	1	2	3	4	5	6	7	8
33.	I am hopeless when it comes to **HEALTH** classes	1	2	3	4	5	6	7	8
34.	I learn things quickly in most **SCHOOL SUBJECTS**	1	2	3	4	5	6	7	8
35.	Work in **COMPUTER STUDIES** classes is easy for me	1	2	3	4	5	6	7	8
36.	Most things I do, I do well	1	2	3	4	5	6	7	8
37.	I am hopeless when it comes to **ENGLISH LANGUAGE** classes	1	2	3	4	5	6	7	8
38.	I learn things quickly in **HISTORY** classes	1	2	3	4	5	6	7	8
39.	I have always done well in **MATHEMATICS** classes	1	2	3	4	5	6	7	8
40.	Compared to others my age I am good at **P. E** classes	1	2	3	4	5	6	7	8
41.	I get good marks in **ENGLISH LITERATURE** classes	1	2	3	4	5	6	7	8
42.	Work in **ART** classes is easy for me	1	2	3	4	5	6	7	8
43.	I am hopeless when it comes to **SCIENCE** classes	1	2	3	4	5	6	7	8
44.	I learn things quickly in **COMMERCE** classes	1	2	3	4	5	6	7	8
45.	I have always done well in **MUSIC** classes	1	2	3	4	5	6	7	8
46.	Compared to others my age I am good at **GEOGRAPHY** classes	1	2	3	4	5	6	7	8
47.	I get good marks in **INDUSTRIAL ARTS** classes	1	2	3	4	5	6	7	8
48.	Nothing I do ever seems to turn out right	1	2	3	4	5	6	7	8
49.	Work in **FOREIGN LANGUAGE** classes is easy for me	1	2	3	4	5	6	7	8
50.	I am hopeless when it comes to **RELIGIOUS STUDIES** classes	1	2	3	4	5	6	7	8
51.	I learn things quickly in **HEALTH** classes	1	2	3	4	5	6	7	8
52.	I have always done well in most **SCHOOL SUBJECTS**	1	2	3	4	5	6	7	8
53.	I am hopeless when it comes to **COMPUTER STUDIES** classes	1	2	3	4	5	6	7	8
54.	I learn things quickly in **ENGLISH LANGUAGE** classes	1	2	3	4	5	6	7	8
55.	I have always done well in **HISTORY** classes	1	2	3	4	5	6	7	8
56.	Compared to others my age I am good at **MATHEMATICS** classes	1	2	3	4	5	6	7	8
57.	I get good marks in **P. E.** classes	1	2	3	4	5	6	7	8
58.	Work in **ENGLISH LITERATURE** classes is easy for me	1	2	3	4	5	6	7	8
59.	I am hopeless when it comes to **ART** classes	1	2	3	4	5	6	7	8
60.	Overall, most things I do turn out well	1	2	3	4	5	6	7	8
61.	I learn things quickly in **SCIENCE** classes	1	2	3	4	5	6	7	8
62.	I have always done well in **COMMERCE** classes	1	2	3	4	5	6	7	8
63.	Compared to others my age I am good at **MUSIC** classes	1	2	3	4	5	6	7	8
64.	I get good marks in **GEOGRAPHY** classes	1	2	3	4	5	6	7	8
65.	Work in **INDUSTRIAL ARTS** classes is easy for me	1	2	3	4	5	6	7	8
66.	I am hopeless when it comes to **FOREIGN LANGUAGE** classes	1	2	3	4	5	6	7	8
67.	I learn things quickly in **RELIGIOUS STUDIES** classes	1	2	3	4	5	6	7	8
68.	I have always done well in **HEALTH** classes	1	2	3	4	5	6	7	8
69.	Compared to others my age I am good at most **SCHOOL SUBJECTS**	1	2	3	4	5	6	7	8
70.	I have always done well **COMPUTER STUDIES** classes	1	2	3	4	5	6	7	8
71.	Compared to others my age I am good at **ENGLISH LANGUAGE** classes	1	2	3	4	5	6	7	8
72.	I don't have much to be proud of	1	2	3	4	5	6	7	8
73.	I get good marks in **HISTORY** classes	1	2	3	4	5	6	7	8
74.	Work in **MATHEMATICS** classes is easy for me	1	2	3	4	5	6	7	8
75.	I am hopeless when it comes to **P. E.** classes	1	2	3	4	5	6	7	8
76.	I learn things quickly in **ENGLISH LITERATURE** classes	1	2	3	4	5	6	7	8
77.	I have always done well in **ART** classes	1	2	3	4	5	6	7	8
78.	Compared to others my age I am good at **SCIENCE** classes	1	2	3	4	5	6	7	8
79.	I get good marks in **COMMERCE** classes	1	2	3	4	5	6	7	8

80.	Work in **MUSIC** classes is easy for me	1	2	3	4	5	6	7	8
81.	I am hopeless when it comes to **GEOGRAPHY** classes	1	2	3	4	5	6	7	8
82.	I learn things quickly in **INDUSTRIAL ARTS** classes	1	2	3	4	5	6	7	8
83.	I have always done well in **FOREIGN LANGUAGE** classes	1	2	3	4	5	6	7	8
84.	I feel that my life is not very useful	1	2	3	4	5	6	7	8
85.	Compared to others my age I am good at **RELIGIOUS STUDIES** classes	1	2	3	4	5	6	7	8
86.	I get good marks in **HEALTH** classes	1	2	3	4	5	6	7	8
87.	Work in most **SCHOOL SUBJECTS** is easy for me	1	2	3	4	5	6	7	8
88.	Compared to others my age I am good at **HISTORY** classes	1	2	3	4	5	6	7	8
89.	I get good marks in **MATHEMATICS** classes	1	2	3	4	5	6	7	8
90.	Work in **P. E.** classes is easy for me	1	2	3	4	5	6	7	8
91.	I am hopeless when it comes to **ENGLISH LITERATURE** classes	1	2	3	4	5	6	7	8
92.	I learn things quickly in **ART** classes	1	2	3	4	5	6	7	8
93.	I have always done well in **SCIENCE** classes	1	2	3	4	5	6	7	8
94.	Compared to others my age I am good at **COMMERCE** classes	1	2	3	4	5	6	7	8
95.	I get good marks in **MUSIC** classes	1	2	3	4	5	6	7	8
96.	Overall, I am a failure	1	2	3	4	5	6	7	8
97.	Work in **GEOGRAPHY** classes is easy for me	1	2	3	4	5	6	7	8
98.	I am hopeless when it comes to **INDUSTRIAL ARTS** classes	1	2	3	4	5	6	7	8
99.	I learn things quickly in **FOREIGN LANGUAGE** classes	1	2	3	4	5	6	7	8
100.	I have always done well in **RELIGIOUS STUDIES** classes	1	2	3	4	5	6	7	8
101.	Compared to others my age I am good at **HEALTH** classes	1	2	3	4	5	6	7	8
102.	I get good marks most **SCHOOL SUBJECTS**	1	2	3	4	5	6	7	8
103.	I learn things quickly in **COMPUTER STUDIES** classes	1	2	3	4	5	6	7	8
104.	I have always done well in **ENGLISH LANGUAGE** classes	1	2	3	4	5	6	7	8
105.	It is important to me to do well in **COMPUTER STUDIES** classes	1	2	3	4	5	6	7	8
106.	It is important to me to do well in **ENGLISH LANGUAGE** classes	1	2	3	4	5	6	7	8
107.	It is important to me to do well in **HISTORY** classes	1	2	3	4	5	6	7	8
108.	It is important to me to do well in **MATHEMATICS** classes	1	2	3	4	5	6	7	8
109.	It is important to me to do well in **P. E.** classes	1	2	3	4	5	6	7	8
110.	It is important to me to do well in **ENGLISH LITERATURE** classes	1	2	3	4	5	6	7	8
111.	It is important to me to do well in **ART** classes	1	2	3	4	5	6	7	8
112.	It is important to me to do well in **SCIENCE** classes	1	2	3	4	5	6	7	8
113.	It is important to me to do well in **COMMERCE** classes	1	2	3	4	5	6	7	8
114.	It is important to me to do well in **MUSIC** classes	1	2	3	4	5	6	7	8
115.	It is important to me to do well in **GEOGRAPHY** classes	1	2	3	4	5	6	7	8
116.	It is important to me to do well in **INDUSTRIAL ARTS** classes	1	2	3	4	5	6	7	8
117.	It is important to me to do well in **FOREIGN LANGUAGE** classes	1	2	3	4	5	6	7	8
118.	It is important to me to do well in **RELIGIOUS STUDIES** classes	1	2	3	4	5	6	7	8
119.	It is important to me to do well in **HEALTH** classes	1	2	3	4	5	6	7	8
120.	It is important to me to do well in most **SCHOOL SUBJECTS**	1	2	3	4	5	6	7	8
121.	I am satisfied with how well I do in **COMPUTER STUDIES** classes	1	2	3	4	5	6	7	8
122.	I am satisfied with how well I do in **ENGLISH LANGUAGE** classes	1	2	3	4	5	6	7	8
123.	I am satisfied with how well I do in **HISTORY** classes	1	2	3	4	5	6	7	8
124.	I am satisfied with how well I do in **MATHEMATICS** classes	1	2	3	4	5	6	7	8
125.	I am satisfied with how well I do in **P. E.** classes	1	2	3	4	5	6	7	8
126.	I am satisfied with how well I do in **ENGLISH LITERATURE** classes	1	2	3	4	5	6	7	8
127.	I am satisfied with how well I do in **ART** classes	1	2	3	4	5	6	7	8
128.	I am satisfied with how well I do in **SCIENCE** classes	1	2	3	4	5	6	7	8
129.	I am satisfied with how well I do in **COMMERCE** classes	1	2	3	4	5	6	7	8
130.	I am satisfied with how well I do in **MUSIC** classes	1	2	3	4	5	6	7	8
131.	I am satisfied with how well I do in **GEOGRAPHY** classes	1	2	3	4	5	6	7	8
132.	I am satisfied with how well I do in **INDUSTRIAL ARTS** classes	1	2	3	4	5	6	7	8
133.	I am satisfied with how well I do in **FOREIGN LANGUAGE** classes	1	2	3	4	5	6	7	8
134.	I am satisfied with how well I do in **RELIGIOUS STUDIES** classes	1	2	3	4	5	6	7	8
135.	I am satisfied with how well I do in **HEALTH** classes	1	2	3	4	5	6	7	8
136.	I am satisfied with how well I do in most **SCHOOL SUBJECTS**	1	2	3	4	5	6	7	8