A CASE STUDY ON HOW MEETING THE ACADEMIC NEEDS OF STUDENTS
SUBSTANTIALLY BELOW GRADE LEVEL IN MATHEMATICS AFFECTS
THEIR SELF-EFFICACY BELIEFS AND ENGAGEMENT

by

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ABSTRACT

A Case Study on How Meeting the Academic Needs of Students Substantially Below Grade Level in Mathematics Affects Their Self-Efficacy Beliefs and Engagement

by

Lauren K. M. Burton, Doctor of Philosophy

Utah State University, 2018

Students who reach ninth grade four or more years below grade level (herein referred to as substantially below grade level) in mathematics require interventions to help close their achievement gaps. This QUAL + quan convergent parallel mixed methods case study examined how meeting the needs of these students by providing a structure that addressed teacher effect, teacher-curriculum effect, peer-curriculum effect and peer effect. The researcher used qualitative and quantitative data to evaluate how these four effects influenced self-efficacy and four types of engagement (cognitive, behavioral, emotional, and social). This small mixed-methods case study \((n = 19)\) took place at a very large middle school (approximately 2,100 students) in the intermountain west.

Axial codes related to the four teaching effects helped define the changes inferred
from the qualitative data emerging from six classroom observations and student and teacher interviews throughout the four-month study. The researcher gathered quantitative data from students’ pre- and post-implementation surveys. Qualitative data showed a positive change in the behaviors associated with self-efficacy and all four engagement types. Quantitative data showed an increase in self-efficacy and all engagement types, but showed a statistically significant increase only in self-efficacy, cognitive engagement, and behavioral engagement. Findings indicated that the convergent results related to all four teaching effects. While qualitative data showed a strong positive change associated with the divergent results of social and emotional engagement, students self-reported little social and emotional peer influence in student interviews and student surveys.
PUBLIC ABSTRACT

A Case Study on How Meeting the Academic Needs of Students Substantially Below Grade Level in Mathematics Affects Their Self-Efficacy Beliefs and Engagement

Lauren K. M. Burton

This researcher examined an alternative classroom structure for ninth-grade students substantially below grade level (SBGL) in mathematics. This researcher considered whether targeting the academic and social needs of students SBGL in mathematics in a ninth-grade class would increase their self-efficacy and engagement with the mathematics by studying four teaching effects: teacher, teacher-curriculum, peer-curriculum, and peer.

The researcher used interviews, observations, and surveys to collect qualitative and quantitative data. The case study ($n = 19$) employed a QUAL + quan convergent parallel mixed methods case study. Meta-inferences from the analyses of qualitative and quantitative data indicate that the structure of the observed class increased in positive behaviors associated with self-efficacy, cognitive engagement, and behavioral engagement. While the data show an increase in emotional and social engagement, the quantitative data did not show a statistical significance in their increase.

These changes illustrated that these ninth-grade students recognized and willingly worked to close the gaps that they acknowledge they had in their mathematics understanding. Findings indicated that the convergent results of self-efficacy, cognitive
engagement and behavioral engagement related to all four teaching effects. While qualitative data showed a strong positive change associated with the divergent results of social and emotional engagement, students self-reported little social and emotional peer influence in student interviews and student surveys.
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Lauren K. M. Burton
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CHAPTER I

INTRODUCTION

Jared walked onto the basketball court knowing he was the worst basketball player in the class, yet every day, he showed up. He dressed out, stepped into the game knowing he could not dribble, run, or shoot as well as any other player in the class. He ran the laps, missed the free throws and the practice shots, and played the scrimmages every day. What made matters worse was that the coach, overwhelmed by the number of students needing training, always assigned him as the least capable player to play with the varsity ball players. The coach believed that if Jared would play with nine other strong solidly capable players, he would develop some capacity for the game and eventually be able to compete equally with the others in the class. Instead, Jared developed a deep-seated hatred for the game he would never get over.

Educators would find this analogy ridiculous if mathematics teachers implemented instruction in this way in the classroom. In a Mathematician’s Lament, Lockhart (2009) describes an imagined nightmare where enthusiasm and beauty is siphoned from mathematics classrooms. Educators have extended the experience of diminishing enthusiasm to one of humiliation and despair for students who perform several years behind their peers and statewide standards. These students are described in this study as substantially below grade level (SBGL),

Students SBGL in mathematics may react negatively to class structures knowing they do not have the skills to perform similar to their peers (Bartholomew et al., 2018; Eccles et al., 1993). When they believe they will not be successful in their efforts to engage with the mathematics or with other students, they may react with anger, frustration, or avoidance (Kokka, 2017). This researcher analyzed how meeting the academic needs of students identified as SBGL in one ninth-grade classroom resulted in a change in self-efficacy beliefs and engagement behaviors in mathematics classes.
Background of the Problem

Students who perform SBGL in mathematics in middle school implement a variety of coping mechanisms to deal with their frustrations. The teacher, in an effort to include these students may try group work in learning communities, may differentiate instruction, and may design mathematical tasks with low entry points for students of low ability (Lampert, 1990; Stein, Grover, & Henningsen, 1996). Students SBGL in mathematics, however, find themselves without the mathematical content knowledge on which to build understanding of even the most basic mathematics concepts. This lack of mathematics knowledge can cause student anger, frustration, and avoidance (Bandura, 1997, 2001; Kokka, 2017). Additionally, relatively higher-ability students may not create community support within student groups; instead, excluding or demeaning the efforts of students identified as SBGL (Espelage, Holt, & Henkel, 2003). This social rejection intensifies the feelings of inadequacy and despair for students SBGL in mathematics.

In spite of efforts to improve mathematics programs and increase students’ mathematics achievement, a large number of students continue to perform SBGL in mathematics and educators fall short of meeting their needs. Analysts of these Programme for International Student Assessment (PISA) data (“PISA 2017,” n.d.) suggest a significant number of 15-year-old students in the United States do not possess basic problem-solving skills in order to succeed in today’s job market. In the U. S., 23.8% of 15-year old students tested below a level 2 (level 6 being the highest) on the PISA. Of those 23%, 4.9% test approximately four to six years below grade level. The authors of the 2012 report state these low-performing students can only handle the most
basic tasks and will most likely not continue their education beyond high school (PISA), 2014). U. S. education policy makers continue to dictate programs to improve performance, but the 2017 PISA evidence suggests that education reform should come from within schools and classrooms to evoke necessary improvements.

These data indicate a large number of U. S. high school students perform SBGL in mathematics. When students experience this lack of understanding in a core subject, they can become withdrawn, angry, and depressed (Bandura, 1997). This frustration lowers their self-efficacy beliefs and their engagement in the subject and this, in turn, lowers their ability to access the necessary resources to succeed in that subject (Alati, 2011). Parker, Marsh, Ciarrochi, Marshall, and Abduljabbar (2014) state self-efficacy beliefs work in conjunction with self-concept to contribute to the universal success of students taking the PISA. Watt and Goos (2017) believe researchers should consider these factors when approaching appropriate interventions that develop greater mathematics achievement and identity.

Mathematics education researchers agree that meeting low-achieving students’ mathematics needs early increases engagement and self-efficacy (Clements, Sarama, Unlu, & Layzer, 2012). Meeting these needs increases the likelihood these students will improve academic performance and lessens the chance they will later drop out of high school (Bowers & Sprott, 2012a; Gleason & Dynarski, 2002). While the findings from these studies pinpoint some risk factors, researchers do not necessarily agree on the degree of accuracy when using these risk factors to predict academic failure. However, educators may be able to use these risk factors to identify students who may ultimately
drop out as early as ninth and tenth grade (Bowers & Sprott, 2012b). Boyd (2016a) states that no single risk factor directly affects students’ high school dropout rates. Furthermore, Boyd explains high school students’ decision to dropout is due to a culmination of many factors over time (e.g., academic failure, family support, financial need). Thus, to prevent high dropout rates, it may be important for educators to address these factors early in a student’s high school career.

Gleason and Dynarski (2002) recognize that middle and high school intervention educators often enroll struggling students into intervention programs based on risk factors like race or socioeconomic status (SES). These researchers note that while race and socioeconomics may be risk factors, the students enrolled in intervention programs are often not those who would have dropped out. The educators missed the risk factors for those students in greatest risk of dropping out. Instead of focusing on demographics such as race and SES as forms of risk factors, Bowers and Sprott (2012) identify several indicators and student traits that signal a middle or early high school student who might eventually drop out of high school. These indicators and traits include low grades, low attendance, dissocial interactions, academic and social withdrawal, and a reluctance to participate in class activities. Bowers and Sprott (2012) explain, although these indicators are not conclusive evidence that a student will not complete high school, educators can use these indicators early in middle school to target students for interventions. These indicators and traits relate to students’ mathematics ability, motivation, goals, and achievement linked to self-efficacy beliefs and engagement (Parker et al., 2014).

Multiple status and alterable risk factors influence the diminished ability of
students who perform SBGL in mathematics. Status risk factors do not change based on school policy or influence and include gender, SES, ethnicity, and home environment (Freeman & Simonsen, 2015). Alterable risk factors include those that the school can address like behavioral issues, grade performance, and class assignment. Researchers have addressed the factors resulting in success and factors resulting in years of deficit understanding (Dweck, 2008; Leinwand, Huinker, & Brahier, 2014; Middleton, 2013; Panel, 2008; Shin & Raudenbush, 2011). Additionally, students experience social, economic, familial, and other personal frustrations and successes in their middle school years. These frustrations and successes alter their perceptions of success and failure for that year and for years to come (Bandura, 2001, 2006; Rubin, 2003). More pointedly, students with confident beliefs in their cognitive abilities experience greater social and intellectual development and enjoyment and master academic skills more quickly than those with intellectual self-doubt (Bandura 1997).

If students’ self-efficacy beliefs and positive engagement with mathematics increase, students can modify habits created from prior academic deficiencies. These students can then establish goals for higher achievement and work more diligently towards those goals. Some researchers believe enrolling students in higher-level mathematics classes will help students accomplish these goals (Boaler, 2008; Burris, Wiley, Welner, & Murphy, 2008). Results from national and international testing that shows placing all students in high ability classes has not been successful. The following section illustrates how enrolling students SBGL in mathematics in high-level mathematics classes affects their mathematics achievement.
The Achievement of Students SBGL in High-Level Mathematics Classes

In the early 2000s, many state education leaders in the U. S. recommended that all general education eighth-grade students should take algebra, an advanced mathematics class for eighth-grade students (Bayard, 2012; Domina, 2014; Schmidt, Cogan, & Houang, 2009). While not all educators followed this suggestion, this belief led to what some researchers refer to as a world-wide effort to provide access and equity to all students by enrolling them in advanced classes (Loveless & Brookings Institution, 2008; H. Marsh & Hau, 2003). The number of U.S. eighth-grade students classified as low-ability and enrolled in eighth-grade algebra classes more than doubled from 3% in 2000 to 7.8% in 2005 (Loveless & Brookings Institution, 2008). This equates to approximately one out of every 13 students in a high-level mathematics course performing SBGL in mathematics (Loveless & Brookings Institution, 2008).

Indeed, the U. S. national eighth-grade mathematics test or National Assessment of Educational Progress (NAEP) has shown a steady rise for eighth-grade students’ mathematics achievement scores since the inception of the test in 1990. This overall increase in scores continued until 2015 and was largely explained by this practice, Title 1 programs, and a change in mathematics curricula (Kim, 2017; “NAEP - 2015 Mathematics & Reading - Mathematics - National Average Scores,” n.d.; Rothman, 2012; R. M. Simzar, Domina, & Tran, 2016a). In this assessment, the scores of higher-ability students enrolled in algebra did not change significantly. Scores for students who perform SBGL in algebra, however, scored notably lower (NAEP, n.d.).

Students SBGL in mathematics have gaps in their understanding spanning years
of core mathematics knowledge. Teachers need to find a way to challenge and support students on grade level academically while attempting to fill the gaps of students with lower ability (R. M. Simzar, Domina, & Tran, 2016b). In addressing this concern, educational researchers should investigate how teachers can build students’ self-efficacy and students’ mathematical engagement with grade-level mathematics.

**Teaching Low-Achieving Students**

The first factor to consider is teacher effect. The researcher operationalizes teacher effect as the quality of the teacher and the relationship a teacher develops with a student. Teacher effect is one of the most influential factors related to student self-efficacy and engagement (Deacon, 2012). Thus, in this study, teacher effect, where teacher proficiency and expectations are high, is the first variable this researcher will consider when developing an effective mathematics course for students who perform SBGL in mathematics.

The second factor to consider is teacher-curriculum effect. Researchers have found that mathematics achievement aligns with the preparation and proficiency of the teacher (Ball, Thames, & Phelps, 2008; Black, 2011). This proficiency includes how to implement mathematics instruction competently while appropriately targeting instruction for the students’ abilities. Scholars, educators, and administrators provide professional development to help teachers implement lesson plans and assignments through school, district, and state trainings (Glass, 2009; Wilds, 2014). Some scholars suggest that in order to increase students’ self-efficacy and their engagement, educators should group students heterogeneously by ability and flexibly differentiate lessons within those groups.
(Glass, 2009; Wilds, 2014). Heterogeneously grouping students by ability in a single classroom requires teachers to differentiate their instruction to multiple levels effectively (Cummins, 2017). Even when teachers become proficient with instructing through differentiation, task implementation, and curriculum development, they express frustration when planning and differentiating mathematics lessons for widely diverse ability groups (Buffum & Mattos, 2015; Loveless, 2013).

Loveless (2008) found that teachers experienced challenges differentiating for students well above or below grade level. Expanding the variability of student abilities by several grade levels within a classroom increases the challenge of teaching mathematics curricula while matching the academic needs of all students to nearly impossible (Buffum & Mattos, 2015).

An unintended consequence of trying to meet the needs of low-ability students occurs as teachers adjust curriculum for content accessibility. All students, including those with high ability, require rigor and challenge to increase their mathematics cognition (Burris et al., 2008). Students with low-ability often do not grasp the more challenging concepts at the same rate as high-ability students (Loveless & Brookings Institution, 2008). In this case, teachers may dilute rigor and challenge to make the content more accessible within the class time constraints (Chiu et al., 2008; Loveless & Brookings Institution, 2008). This then diminishes the cognitive demands on students who grasp the intended content quickly or easily (Schmidt et al., 2009). If the gap between low and high-ability is too great within a classroom, lowering the cognitive demand then disadvantages the higher-ability students in the class (Duflo, Dupas, &
Kremer, 2011; Schmidt et al., 2009). Thus, the second variable this researcher will address is teacher-curriculum effect or a teacher uses and adapts the curriculum when meeting the needs of students identified as SBGL.

The third factor, peer-curriculum effect involves students’ peers and peers’ perceptions of and participation in class and with the curriculum. Peers influence why and how students engage in mathematics classes (Rossman, 2013). Peers can positively or negatively affect students’ attitudes about a class or curriculum and help define the self-efficacy beliefs and engagements behaviors students SBGL develop (Schenke, Lam, Conley, & Karabenick, 2015). For instance, students who experience similar beliefs as their peers when setting learning goals, participating in class, and following rules and procedures can develop a stronger community of support.

The fourth factor is peer effect. Educators should address social influences of behavior and how students compare their ability to that of their peers. Middle school students develop their sense of self as adolescents with peers as one of the greatest influences social and academic development (Li, Doyle Lynch, Kalvin, Liu, & Lerner, 2011). If low-ability students see their high-ability peers grasping challenging content more quickly and easily, this decreases their performance-approach goals compared to their counterparts placed in general mathematics classes (R. M. Simzar et al., 2016a). Placing students in a class where they can demonstrate competence of the curriculum on par with their class peers can increase students’ self-efficacy beliefs and their engagement. Thus, in this study, this researcher will consider the effect peers have on students identified as SBGL in mathematics.
To meet the purpose of this research study, the researcher examined how teacher quality, peer support, and providing an appropriate curriculum affect the self-efficacy beliefs and observable engagement indicators of ninth-grade students who perform SBGL in mathematics when enrolled in an essential skills class (ESC). Researchers have found a strong correlation between class structure and student engagement in mathematics (Lamb & Fullarton, 2002; Uçar & Sungur, 2017). The findings from these studies describe factors relating strongly to the social context in which students demonstrate their academic performance. Positive and negative social pressures from students’ peers may affect students’ self-efficacy beliefs and their engagement. Peers affect how students perceive their own achievements and how they react to school and class structures (Chiu et al., 2008; Madjar & Chohat, 2017; H. Marsh & Hau, 2003).

Prior research that focuses on the above factors addresses student performance and academic achievement (Cesario, 2007; Duflo et al., 2011; Sakiz, Pape, & Hoy, 2012). In this study, this researcher addresses how these factors relate to students’ self-efficacy beliefs and student engagement. More specifically, this study considers these effects relative to a sub population of students who perform SBGL in mathematics. If self-efficacy beliefs and engagement for students who perform SBGL in mathematics change positively, researchers can address other related interventions to help those students improve academic achievement. Thus, when meeting the needs of students SBLG in mathematics, four factors affecting self-efficacy beliefs and engagement are: (a) teacher effect, (b) teacher-curriculum effect, (c) peer-curriculum effect, and (d) peer effect.
Statement of the Problem

Since 2000, an average of 68% of 15-year-old students tested below proficient and 30% of 15-year-old students in the U.S. tested Below Basic on the National Assessment of Educational Progress mathematics test (“2017 NAEP Mathematics: national achievement-level results,” n.d.). The 2017 NAEP showed an increase in the average scores of students in eighth grade where 34% of students showed proficiency on the test, but 30% of students scored below Basic (“2017 NAEP Mathematics: national achievement-level results,” n.d.). This shows a 1% rise in the number of students who cannot understand the rudiments of eighth-grade mathematics. Interestingly, the discrete data by racial demographic show a 2% increase in Caucasians students scoring below Basic. Every other demographic except Hispanics remained decreased the number of students scoring below Basic, remained static, or increased the number of students scoring below Basic by only 1%. (Hispanics showed an increase in students scoring below Basic of 3%.) These data indicate the concern for helping low-ability students crosses the racial divide and should be considered a universal issue.

These data reveal the need to examine students SBGL in mathematics considering the rise in the average score of one point occurred as a result of the scores from the top 10% of students. Their scores offset the lower 10% of students’ scores for a cumulative rise of 1%. The scores of the lowest 10% of students increased the achievement gap between the top 10% of students by an additional six percent since 2015 (Barshay, 2018).

After the release of the report, the National Superintendents Roundtable and the Horace Mann League explained that proficiency on the NAEP does not necessarily
correlate with grade level achievement because states curricula and standards vary greatly (“2017 NAEP sees almost no growth in US students’ math, reading scores,” n.d.). In the same article, the National Center for Education Statistics (NCES), which administers the NAEP, released a statement saying, “Proficient denotes solid academic performance demonstrating competency over challenging subject matter.... Proficient is not the same as being ‘on grade level,’ which refers to student performance based on local standards and curriculum that can vary among school districts.”

This distinction refutes any relevance to the test. If NCES created the test to assess grade-level concepts, students should demonstrate “solid academic performance demonstrating competency” on those concepts regardless of the curricula or standards. Therefore, this researcher considers this test as an indicator that students who performed below proficient performed below grade level. Furthermore, she will consider students performing below Basic as students SBGL in mathematics.

These data illustrate students SBGL in mathematics may have struggled for years before they reach ninth grade. This performance could explain and/or contribute to a decrease in students’ mathematics motivation and a decrease in students’ interest in secondary mathematics (Watt & Goos, 2017). This struggle also results in diminished self-efficacy beliefs and engagement, which, by extension, diminishes achievement (Alati, 2011; Domina, 2014). In the following section, this researcher will address the research questions addressed in the study.

**Research Questions**

To investigate how to meet the needs of students SBGL in mathematics, this study
will address the four factors of teacher effect, teacher-curriculum effect, peer effect, and peer-curriculum effect in a class of students homogeneously grouped by ability. The overarching research question in this study was “How does addressing the needs of middle school students SBGL in mathematics by aligning teacher quality, peer support, and appropriate curriculum affect the students’ self-efficacy beliefs and engagement in mathematics classes?” The study focused on the following three research questions.

1. How do students SBGL in mathematics exhibit observable engagement, if any, when teacher, curriculum, and peer focus align with their academic needs?

2. What self-efficacy indicators, if any, emerge in mathematics classes when teacher, curriculum, and peer focus align with the academic needs of students SBGL?

3. How do self-efficacy beliefs and observable engagement indicators change when addressing teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect that focus on the academic needs of students SBGL?

**Purpose of the Study**

This study examined the changes in the self-efficacy beliefs and mathematics engagement of students SBGL in mathematics when their needs were met by addressing the effects of the class structure that includes teacher, curriculum, and peers. Some researchers found, by ability grouping low-ability students, the students’ self-efficacy beliefs and their positive engagement behaviors increased (Chiu et al., 2008; Chmielewski, Dumont, & Trautwein, 2013; Freed, 2013; H. Marsh & Hau, 2003). Conducting this study explained factors relating to students’ self-efficacy beliefs in mathematics when grouped homogeneously by ability. The class structure for the study included a curriculum adjusted to fall within the perceived ability levels of the student
where the teachers believed the students could and would experience success.

This researcher examined how placing students who perform SBGL in mathematics in a social context aligned to meet their needs changed student self-efficacy and engagement with mathematics concepts within their ability to succeed given the help of teachers and peers. As they experienced success with these concepts, they improved their self-efficacy beliefs and engagement indicators. This, in turn, increased the likelihood they will set and achieve higher mathematical goals (Bandura, 1997).

**Significance of this Study**

This mixed-methods study could have implications for and lead to further research into school interventions for students who perform SBGL in mathematics. Additionally, this research could lead to a study about how students of other ability levels establish and exhibit self-efficacy beliefs and engagement in ability groups.

While educators may not agree on how to educate high, regular, and low ability students, this study offered an approach for how to meet the needs of students who perform SBGL in mathematics by increasing self-efficacy beliefs and engagement. In middle school, educators can greatly influence student self-efficacy beliefs and engagement. This study analyzed whether the structure in the class for the study actually met the needs of the students and helped increase self-efficacy and engagement.

**Research Design**

This researcher used a QUAL + quan convergent parallel mixed methods case study (Creswell, 2013) to investigate meeting the needs of students SBGL in
mathematics. In this study, she addressed four factors: teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect in a class of students homogeneously grouped by ability. The researcher used a convergent method to gather and analyze the qualitative and quantitative data separately. The study is a parallel study in that both the qualitative data and the quantitative data were gathered in Phases I and III although the researcher only gathered qualitative data in Phase II. The researcher used the same items to answer the research questions about self-efficacy and the four engagement types: cognitive, behavioral, emotional, and social. After analyzing the separate data types, the researcher then conducted a side-by-side comparison of the data to confirm or disconfirm the results from the separate qualitative and quantitative analyses (Creswell, 2013).

Creswell (2013) states, “Unquestionably, the data for the qualitative data collection will be smaller than that for the quantitative data collection” (pg. 269). This traditionally results from the sample sizes used in the qualitative and quantitative data collections. In this study, however, the researcher used several qualitative data sources and a single quantitative data student surveys. Although the researcher focused these multiple qualitative data sources mainly on six participants (the classroom teacher and five students), the richness of the qualitative data created a much larger data set than those data collected in the quantitative surveys.

Analysis of open codes during the study led to the development of open-ended questions for student interviews throughout the study. During Phase III, the researcher used the open codes to develop axial codes which related to the study factors of teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect.
The researcher also gathered quantitative data from student pre and post-implementation surveys to gauge self-reported changes in self-efficacy and engagement. The researcher adapted the survey items from previously validated tools developed by other researchers as described in the Data Sources and Instruments section. After separately analyzing these data, the researcher mixed the qualitative and quantitative data to understand how the two data types converged and diverged.

**Assumptions**

This study examined how self-efficacy and engagement of a group of ninth-grade students who performed SBGL in mathematics and grouped together for instruction changed over the course of 4 months. Extraneous factors like family dynamics, socioeconomic status (SES), parent effect, and extra-curricular social context influence self-efficacy and engagement. Although these factors influence student performance, student attitudes and beliefs mediate those effects in the middle years (Cleary, Velardi, & Schnaidman, 2017). Therefore, this study focused on the self-reported attitudes and beliefs affecting students’ self-efficacy and their mathematics engagement. This study explored how students who perform SBGL in mathematics improved their self-efficacy beliefs and engagement by providing a separate and deliberate structure involving the alignment of student needs. This structure provided two teachers facilitating a modified grade-level curriculum to students with peers at a similar academic level. This study, however, did not explain how changes in self-efficacy and engagement affect mathematics achievement nor how ability grouping may relate to the self-efficacy beliefs and engagement of students SBGL in mathematics.
Limitations

The small number of students in this study limits generalizing the conclusions of this study. The study began with one class of 25 students in a predominantly white mid-socioeconomic school. Therefore, this study is not generalizable to larger populations. This study may, however, inform research designs for future larger more generalizable studies investigating how to meet the academic needs of students who perform SBGL in mathematics regarding self-efficacy beliefs and engagement. The implications are limited to this population. However, the descriptions of the structures used in the study may inform how educators structure mathematics classes for low-ability students, professional development for new and experienced teachers of low-ability students, and curriculum developed to provide access to high-level mathematics for low-ability students.

The students in this study attended a school in a predominantly white, mid-SES, predominantly religious, suburban area in the intermountain west. Approximately 90% of the school’s student population rode a bus to school. Fewer than 20% of the students at the school received free or reduced lunch. The teachers had ample supplies, technology, and equipment indicating a tax base for the school, which provided money for school and teacher support for the implementation of intervention programs. The researcher provides no conclusive evidence as to how this study and its results might differ in a different setting or with a different population.

This researcher is a Caucasian female teacher having taught mathematics for 13 years and employed for eight years at the school where the study took place. She helped develop the program described in this study over the past five years after recognizing that
traditional interventions were inadequate to support the needs of students SBGL in mathematics. She recognizes the inherent bias to show the efficacy of this program and used multiple data sources to triangulate the data and minimize this bias.

Conclusion

Data from national and international tests indicate an increasing number of students perform SBGL in mathematics (Fleischman, Hopstock, Pelezar, Shelley, & National Center for Education Statistics (ED), 2010; “NAEP - 2015 Mathematics & Reading - Mathematics - National Average Scores,” n.d.; Programme for International Student Assessment (PISA), 2014; Schmidt, 2012). Many studies discuss access and equity for at risk demographics and high and low ability groups. Few researchers have examined the large number of students testing far below proficiency and how to meet the needs of those students while increasing their mathematics ability and achievement.

NAEP and PISA analysts note students of all demographics struggle with mathematics often at a level years below their peers (Fry, 2007; Loveless, 2013; “NAEP - 2015 Mathematics & Reading - Mathematics - National Average Scores,” n.d.; Programme for International Student Assessment (PISA), 2014). Findings from these studies also note students SBGL in mathematics often drop out of high school with minimal mathematics ability and are ill-prepared for real-world mathematics tasks (Fleischman et al., 2010; Programme for International Student Assessment (PISA), 2014).

This case study addressed four factors of “effect” that educational researchers deemed as important as illustrated above. The four factors are (a) teacher effect, (b) teacher-curriculum effect, (c) peer-curriculum effect, and (d) peer effect.
Definitions

Researchers have used many terms throughout education history and developed multiple meanings associated with ability grouping and intervention measures. This researcher used the following common terms to provide an explanation of how they apply to this study.

**Ability grouping:** separating students by similar mathematical ability into homogeneous classes. Ability grouping differs from tracking in that educators may assign students to different ability-leveled classes ranging from remedial to advanced levels on a class-by-class basis (Rubin, 2003). Ability grouping occurs independently by domain in that grouping does not cross disciplines and recognizes that students struggling in one area (like mathematics) may not struggle in a distinct area (like English). Ability grouping may include evaluating and moving a student into a different level of mathematic as needed (Craver & Philipsen, 2011; Gamoran, 2009a).

**Adapted standards:** mathematics grade-level standards required by the state but altered by the teacher so students build a foundation of those most essential to the current and future success of a student who performs substantially below grade level.

**BFLP effect:** Big Fish Little Pond (BFLP) Effect which affects how low-ability students may become role models for other low-ability peers when placed in homogeneous ability groups (H. Marsh & Hau, 2003).

**Confidence:** “a nondescriptive term that refers to strength of belief but does not necessarily specify what the certainty is about...Confidence is a catchword rather than a construct embedded in a theoretical system (Bandura, 1997, pg. 382) In other words,
confidence applies to how students appreciate their ability to complete assignments related to a general topic.


**Mathematics ability:** capacity of students classified by scholars as either cognitive or pragmatic. In this study, the term ability referred to the pragmatic definition of mathematics ability and how well a student can perform and complete grade level mathematics tasks (Karsenty, 2014). This is in contrast to the concept of cognitive mathematics ability that refers to a student’s capacity to obtain, process, or retain mathematics content or information. Standard classifications of ability include low-ability (unable to fluidly compute), regular (on par with peer performance), or high (exceeds expectations of ability for this age group) (Karsenty, 2014).

**Middle school:** the structure of educating students between elementary and high school years. The definition of middle school fluctuates from setting-to-setting based on age designation and school purpose. Often, middle schools span grades six through eight. The middle school in this study included students in grades seven through nine or approximate ages 13 through 15.

**Prosocial/dissocial interactions:** social relationships which create either positive or negative influences in a group respectively (Bandura, 1997).

**Self-concept:** a way in which a person evaluates his or her ability to understand
mathematics problems (Chiu et al., 2008; Parker et al., 2014).

**Self-efficacy**: the perceptions one has about ability or competence. Research indicates self-efficacy may have a slightly stronger influence on achievement than self-concept (Parker et al., 2014). Bandura (2001) explains that self-efficacy beliefs influence people’s perception of self and whether they have a positive or negative image of personal capability that is either self-enhancing or self-hindering.

**Substantially below grade level (SBGL)**: a mathematics proficiency lower than approximately four or more years of the student’s assigned grade level as determined by assessment results and teacher observation.
CHAPTER II
LITERATURE REVIEW

National and international test results reveal the diminishing scores for students whose performance indicates ability substantially below grade level (SBGL) in mathematics (Loveless & Brookings Institution, 2008; “NAEP - 2015 Mathematics & Reading - Mathematics - National Average Scores,” n.d.; PISA, 2014). To assure all students receive access to high-quality instruction, mathematics educational researchers should address this issue affecting a growing number of approximately 120,000 students annually (Loveless and the Brookings Institution, 2008).

Pedagogical theorizing draws from past research on cultural and social influences and implications of learning as well as cognitive development. Daniels, Lauder, and Porter (2012) note that effective pedagogy ensures teachers reflect on culturally specific ideas of teaching and formalizing policy and structure within the culture of a classroom. Researchers have mixed the sociocultural research of Vygotsky and Kant (John-Steiner & Mahn, 1996; Kant, Pluhar, & Kitcher, 1996) with the social cognitive research of Bandura (Bandura, 1993, 1997, 2001) and linked sociocultural and social cognitive theories to self-efficacy and engagement (Bandura, 1993; Freed, 2013; Meissel & Rubie-Davies, 2016; Parker et al., 2014; Skaalvik, Federici, & Klassen, 2015; You, Dang, & Lim, 2016). Applying these theories to understand why and how students fall behind grade-level expectations may help educators fill mathematics achievement gaps.

Researchers have recommended placement of students SBGL into eighth grade algebra classes. They stress that educators should differentiate lessons within
heterogeneously grouped mathematics classes to provide low-achieving students with high-quality, high-level instruction (Glass, 2009; National Council of Teachers of Mathematics [NCTM], 2017; Wilds, 2014). These researchers found that differentiation provides all students (even students SBGL in mathematics) access to high-level content with support of high-quality teachers and supportive high-ability peers (Boaler, 2008; Darling-Hammond, 1995; Marx, 2016; NCTM, 2017). Results from the 2017 NAEP indicate that students SBGL in mathematics continue to struggle with scores that dropped by two points from 2015. In spite of, or because of, this common placement practice the achievement gap grew six points between the top 10% and the lowest 10% of eighth grade students (Loveless, 2018). The ensuing review of past and current literature as well as the theoretical lens and conceptual framework provided a means to understand the factors of teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect within the social and cultural structure of the classroom. Additionally, this study examined how these factors influenced self-efficacy beliefs and engagement for students who performed SBGL in mathematics.

To present these effects and the conceptual aspects of the related literature clearly, this chapter is organized into six sections. The first section introduces the research questions. The second section discusses the needs of students who perform substantially below grade level in mathematics. The third section presents the theoretical lens of the study approach. The fourth section outlines the conceptual framework of the study. The fifth section discusses a review of the literature investigating student self-efficacy beliefs and engagement. The sixth section discusses how to identify student self-efficacy beliefs...
and engagement.

**Research Questions**

Researchers debate the effects of grouping practices for low-ability students, but Gamoran (2009) states that success for low-ability students depends less on the grouping than upon the intent of the grouping, the difference in content, and the method, pace, and instructional techniques of the teacher. Additionally, grouping practices alone have little effect on student achievement if not complemented with curricula appropriate for the ability of the targeted students while still challenging these students (Tieso, 2005). To address this research issue, the overarching research question in this study was “How does addressing the needs of middle school students SBGL in mathematics by aligning teacher quality, peer support, and appropriate curriculum affect the students’ self-efficacy beliefs and engagement in mathematics classes?” More specifically, this researcher attempted to answer the following three research questions.

1. How do students SBGL in mathematics exhibit observable engagement, if any, when teacher, curriculum, and peer focus align with their academic needs?

2. What self-efficacy indicators, if any, emerge in mathematics classes when teacher, curriculum, and peer focus align with the academic needs of students SBGL?

3. How do self-efficacy beliefs and observable engagement indicators change when addressing teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect that focus on the academic needs of students SBGL?

**Focusing on the Needs of Students SBGL in Mathematics**

When investigating the needs of students SBGL in mathematics, this researcher
considered *specialized instruction* more fully. Specialized instruction requires high-quality teachers who are able to address the challenges of students SBGL in mathematics (Averill, Anderson, & Drake, 2015). Teachers of students SBGL in mathematics should be able to design and implement a curriculum appropriate for students’ learning needs by falling within the students’ ability to experience success. The structure of the mathematics class should include appropriate peer interactions. These interactions help develop self-efficacy and engagement essential to increasing achievement (Barth, Dunlap, & Dane, 2004). Understanding these contributors (teacher, curriculum, and peers) could help educators meet the needs of students SBGL in mathematics and affect a potential change of their self-efficacy beliefs and engagement. The following section provides more details about the theoretical lens for this study and includes both the social and the cultural theories describing the cognitive development of students SBGL in mathematics.

**Theoretical Lens**

Sociocultural and social cognitive theories on cognitive development merge when researchers study the learning needs of students SBGL in mathematics. When developing his social cognitive theory, Bandura (1993) stated, “Children's intellectual development cannot be isolated from the social relations within which it is imbedded or from its social consequences. It must be analyzed from a sociocultural perspective” (pg. 120). Middle school students develop self-efficacy beliefs and engagement through academic, social, and cultural influences. These influences affect students’ help-seeking, anxiety, cheating, metacognitive strategies, responses to conflict, and understanding (R. M. Simzar et al.,
In a middle school classroom, mathematics educators may have to address these influences before or in conjunction with academic concerns.

The theoretical lens for this study blends sociocultural and social cognitive paradigms. Sociocultural theory draws from the environment and social influences and addresses how cultural influences at home and at school influence self-efficacy and engagement. Social cognitive theory explains that students develop self-efficacy and engagement within the social structure of the class, maintain skills developed in the class, and propagate their knowledge directly and indirectly through social interaction (Hickey & Zuiker, 2005).

**Sociocultural Theory**

In his sociocultural theory, Vygotsky (Vygotsky, 1980) found that students maximize learning opportunities when receiving content within the student’s ability to succeed and with the help of a *more knowledgeable other* (MKO). In order for students to learn grade-level mathematics, they need to relate their understanding to concepts within their ability to succeed to concepts previously understood (Skemp, 1978). This understanding and capacity for success vary greatly among students heterogeneously grouped by ability.

Students have opportunities to build understanding of mathematics concepts through three different types of interactions within the classroom. First, how the teacher structures social interactions can affect student receptivity to mathematics curricula (McLoughlin, 2009; Zimmer & Toma, 2000). Second, student interactions also differ depending on how students perceive teacher and peer relationships (Hickey & Zuiker,
2005; Isiksal-Bostan, 2016; Ordonez-Feliciano, 2010). Lastly, the pedagogical structure of the class including the student’s motivation and perceived locus of control also affects learning (Bandura, 1997; Sakiz et al., 2012).

In Vygotsky’s (1980) sociocultural theory, students relate to and share the common culture and structure of their class. They form communities wherein they build understanding together and/or turn to the teacher for support and guidance (Daniels, Cole, & Wertsch, 2007; Kant et al., 1996). In middle school, students build mathematics understanding upon elementary mathematics concepts or a posteriori learning.

If students have passed year-to-year without filling gaps in knowledge, the learning deficit may compound until their mathematics knowledge may lag years behind that of their peers (Loveless & Brookings Institution, 2008). If a grade-level task then falls outside of a student’s ability level and/or the student cannot relate to the relevant information of a mathematics task, the student grows uncertain and unmotivated to complete assigned tasks (Daniels, 2016). When students cannot relate to the mathematics in their classroom, their degree of engagement and self-efficacy decreases (Christenson et al., 2012). This limits the student’s ability to develop relational understanding by making connections to the new content (Skemp, 1974) lowering students’ mathematics self-efficacy. Conversely, placing students in an environment where they can build relational understanding from their prior experience of content and then extend that understanding to grade level material helps fill their gaps in learning and increase self-efficacy and engagement.

This postmodern paradigm with a socio-cognitive/socio-cultural lens challenges
findings suggesting the separation of students by ability diminishes the equitable access to high-level mathematics learning for low-ability students (Boaler, 2008; Burris et al., 2008; Craver & Philipsen, 2011; Mills, 1998a). Placing students in a class structure which builds upon students’ a posteriori understanding allows educators opportunities to address students’ relational needs when learning grade-level curriculum.

**Social Cognitive Theory**

Social cognitive theorists believe students work to produce and shape cognition. Bandura (2000) established the social-cognitive theory based on how students developed self-efficacy through their interactions between another person, their own behaviors, and their environment (see also Linnenbrink, 2007). Social cognitive theorists state that adolescent self-efficacy has primary importance as a determinant of their agency and as a predictor of their academic success as well as emotional and behavioral engagement (Cleary et al., 2017; Madjar & Chohat, 2017). Self-efficacy beliefs help determine the students’ degree of effort, persistence, and perseverance when approaching a mathematics task within a class which includes a teacher, curricula, and peers (Usher & Pajares, 2008).

The teacher further defines class structure in how he or she enacts lesson timing and or pace, uses classroom space, implements student grouping, develops the students’ perceived sense of control and safety, and fosters the social relationships between and among students’ peers (Daniels et al., 2012). In spite of these teacher-established structures, students’ peer relationships in middle school play a large role in the development of students’ social cognition as described below.
Middle school students tend to rely on the evaluation of their peers who interpret their ability (Usher & Pajares, 2008). Kudo and Mori (2015) found that middle school students who experience success with peers interpret success and achievement in relation to their vicarious experience with those peers. Yiu, Cheung, and Siu (2012) commented on Bandura’s self-efficacy theory stating the following,

people who have confidence in their capabilities with respect to a specific task anticipate a successful performance, focus their thoughts on how they can succeed, and persist in the face of difficulty while people will avoid tasks for which they have a low level of self-efficacy.

Likewise, if low-ability students perceive their peers as students with low ability, they construe their achievement higher than when they compared themselves to those in higher ability groups (Chmielewski et al., 2013; Nardi & Steward, 2003; Usher & Pajares, 2008). This peer evaluation places importance on student placement in affects self-efficacy.

Social cognitive theory addresses the reactions students have to theoretical cognition constructs as they develop understanding aligned with their actions and emotions (Srull, 2014). This study examined how mathematics self-efficacy beliefs and engagement changed when educators adopted classroom structures aligned to meet the needs of students SBGL in mathematics. The four factors of the structure included: (a) teacher effect, (b) teacher-curriculum effect, (c) peer-curriculum effect, and (d) peer effect. These factors are introduced in the next section as outlined in the conceptual framework for the study.
Conceptual Framework

This conceptual framework addressed the four factors addressed in this study: (a) teacher effect, (b) teacher-curriculum effect, (c) peer-curriculum effect, and (d) peer effect. Within each of the factors, subcategories addressed the changes or specific elements this study addressed. Figure 1 describes how each of the four factors affects self-efficacy beliefs and engagement.

This researcher tracked how students SBGL in mathematics changed their self-efficacy beliefs and observable engagement indicators relating to a class structure designed to meet the needs of students SBGL in mathematics. The following sections present the importance of these four factors.

Figure 1. Conceptual framework illustrating four effects.
**Teacher Effect**

The first circle in the conceptual framework encompasses some elements of teacher effect. Pajares states in an interview with Bembenutty (2007), “Every action a teacher takes toward a student helps shape that student’s competence and the beliefs that accompany that competence” (p. 15). In Figure 1, teacher effect circle encompasses elements of the classroom structure that includes interactions with students and the sub-category of teacher-curriculum effect or how the teacher implements the curriculum. (Teacher-curriculum effect is addressed in the following section.) Teachers establish classroom norms, policy, and atmosphere. Teacher effect is operationalized in this study through (a) teacher quality, (b) students’ relationships with the teacher, and (c) teacher expectations of behavior and participation (Charalambous, Philippou, & Kyriakides, 2008; Duflo et al., 2011; You et al., 2016).

Cummins (2017) revisited the 2002 Duflo Kenyan study to examine Duflo’s findings. Cummins (2017) showed improvements in the ability of students at all levels when schools tracked students by ability. He found that when schools appointed high-quality, well-trained teachers to teach all levels of students, students in low-ability group outperformed students in heterogeneously grouped classes.

Educators and researchers who decry the practice of ability grouping for students SBGL in mathematics state that administrators often select inexperienced or less-abled teachers to teach classes of students with low ability (Boaler, 2008; Burris et al., 2008; Mills, 1998a). Researchers, however, suggest the most important variable in student success is the instruction students receive and how they receive it (Collins & Gan, 2013; Duffy, 2007; Duflo et al., 2011; Gamoran, 2009b; Vaughn, 2012). To increase
effectiveness, administrators should assign the most qualified and capable teachers to
tackle the challenges of teaching students SBGL in mathematics. These challenges
include misbehaviors, closing multi-year gaps in comprehension, and creating an
interesting and engaging curriculum.

Teacher effect also includes teacher perceptions of what students SBGL in
mathematics can learn (Boaler, 2015; Loveless, 2013; McKown & Weinstein, 2008;
Oakes, 2008). Yanisko (2016) suggests teacher training mitigated negative perceptions of
novice teachers and how they approached their instructional practices in low-ability
classes. These novice teachers learned to provide high-quality instruction and convey
high expectations for these students. In order for students who perform SBGL in
mathematics to achieve the greatest outcome, high-quality teachers must believe in the
students’ potential and work to help these students close their learning gaps.

All teachers should develop two important features: (a) high teacher quality and
(b) high teacher expectations. These two elements of teacher effect fall outside of the
elements expected from implementation of the core. They also interact with peer effect to
influence self-efficacy and engagement.

**Teacher quality.** The writers of the 2012 PISA report (2014) recommend that to
increase student mathematics performance, administrators must place the most talented
teachers into the most challenging classrooms. Scholars, however, cannot agree on a
definition for or proper assessment of teacher quality (Connell, 2009; Hanushek &
Rivkin, 2006; M. Kennedy, 2010). Therefore, teacher quality for this study is
operationalized as the level of teacher training and certification, prior teacher evaluation,
years of experience, and teacher self-efficacy (belief in his or her own teaching ability) (Aslam & Kingdon, 2011; Connell, 2009; M. Kennedy, 2010).

In a critical analysis of classroom practices, Au (2011) notes teacher frustrations result from behavioral issues, the pressures of the No Child Left Behind Act, the rise in school and class enrollment, the pressures from high stakes testing, and the demands of altering curriculum to match state mandated testing and curricula. Professional development programs can train high-quality teachers to prepare for these challenges that compound when teaching frustrated students with vast academic gaps (Isiksal-Bostan, 2016).

In summary, selecting high-quality teachers impacts the self-efficacy and engagement of students as their preparation and ability to present the material properly, to control pressures of teaching in today’s classrooms, and to motivate struggling students (Cummins, 2017). High-quality teachers who set high expectations for their students, regardless of ability level, can also affect student performance.

**Teacher-student relationships.** High-quality teachers who build appropriate relationships with middle school students in mathematics can positively affect these students’ perceptions of mathematics and their ability to learn the mathematics (Vaughn, 2012). Low-performing middle school students have years of experience sensing a teacher’s inexperience, frustration, and condemnation (Sakiz et al., 2012). Students may then react by intentionally creating educational conflict in the classroom. Students may perceive teacher frustrations as confirmation of the students’ inability and confirm his or her low self-efficacy. In turn, students may abandon academic goals,
behavior, and effort (Bandura, 2012). Student dissocial actions may also arise from teachers’ reactions to perceived student ability and student behavior (Hart & DiPerna, 2017).

Teachers who can appropriately address their own perceptions of students’ ability to help students achieve success can mitigate these challenges in the classroom. When developing positive student-teacher relationships, researchers find that students engage more with classroom tasks and activities in all engagement areas (cognitive, emotional, behavioral, and social) (Durksen et al., 2017; M. Kennedy, 2010; Uçar & Sungur, 2017). Therefore, high-quality teachers should attempt to foster positive student-teacher relationships.

**Teacher expectations.** While researchers have found that teacher quality and student-teacher relationships play an important role in the development of self-efficacy beliefs and engagement (Connell, 2009; M. Kennedy, 2010; Uçar & Sungur, 2017), teacher expectations of behavior and participation also affect self-efficacy beliefs and engagement (McKown & Weinstein, 2008).

Students recognize teachers’ expectations and beliefs which affect students’ performance (Sakiz et al., 2012). Teachers of students who perform SBGL often lower their academic expectations for those students and believe them incapable of higher-ordered thinking (Boaler, 2015; Gamoran & Mare, 1989; Marks, 2000; Mills, 1998a). Researchers have found that students with teachers who believe all students can succeed have greater self-efficacy beliefs and engagement than those who do not (Cesario, 2007; Muller & Schiller, 2000). Because students recognize and interpret a teacher’s
expectations and beliefs regarding students’ capabilities, teachers should express their belief that students can succeed (Guskey & Anderman, 2013). If teachers maintain high expectations and help students set realistic goals, students may attain higher mathematics achievement goals (Gietz & McIntosh, 2014). A high-quality teacher can set high expectations aligned with the state core even for students SBGL in mathematics.

Students who perform SBGL in mathematics often have a low-self-efficacy attitude of hopelessness and a tendency to avoid expending effort on mathematics tasks (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011). Teachers can alter this self-defeating attitude by requiring students to show mastery of fewer essential concepts and encouraging students to reach attainable learning goals outlined on a simple rubric (Bloom, 1987). Guskey and Anderman (2013) define mastery as showing competence or proficiency in a concept. When students recognize their own success in grade-level standards, their self-efficacy and engagement improves (Bandura, 2012).

When teachers expect mastery on essential standards and support students in developing that mastery, students work to achieve those expectations (Cesario, 2007). When students recognize that teacher expectations are realistic, beneficial, and supportive for current and future success, they experience increased self-efficacy beliefs and engagement.

**Teacher-Curriculum Effect**

How teachers enact the mathematics curriculum can also affect students’ self-efficacy beliefs and engagement when (a) adapting the standards to the students’ needs (Guskey & Anderman, 2013), (b) adjusting the pace of the curriculum (Bloom, 1974),
and (c) confidence (Durksen et al., 2017; Everingham, Gyuris, & Connolly, 2017). These three actions are depicted in the conceptual framework in Figure 1 in the box of Curriculum and Assessment that spans the graphic. While the state may mandate a particular curriculum or set of mathematics standards, teachers choose how they will or will not facilitate the instruction of those standards. Teacher-curriculum effect (if and how a teacher implements the state mathematics core) affects the students’ ability to learn the material and develop self-efficacy and engagement for those standards.

**Adapting the standards to the students’ needs.** Teacher-curriculum effect includes determining what to teach and how curricula may be enacted. Some researchers express the concern that students in low-ability groups receive low quality or “watered-down” instruction (Boaler, 2015; Burris et al., 2008; Mills, 1998a; Schmidt & Cogan, 2009). Teachers who provide below-grade-level curricula to students below grade level retain those students below grade level. In order to close the learning gap for students SBGL, teachers should use grade-level curricula (Buffum & Mattos, 2015). Teachers may take extra time to focus on essential standards (those most critical to understand the core). In linking these concepts to prior learning and experience, students can cognize more content related to grade-level curricula. Teachers of SBGL mathematics students can address core implementation through three practices: (a) assessing student need (b) adjusting standards, and (c) pacing instruction.

**Assessing student need.** Students perceptions about a course are often reflected in assessment achievement (Çiftçi, 2015). This achievement is often tied to self-efficacy and engagement. Frequent formal and informal assessment can help teachers facilitate the
needs of students who perform SBGL in mathematics and can indicate proper student placement (Buffum & Mattos, 2015).

*Student placement assessment.* Placement assessment can help teachers gauge and monitor academic progress and adjust placement as students’ social needs and curriculum proficiency change (Buffum & Mattos, 2015; Council, Education, Education, & Committee, 2001a). If administrators do not implement flexible enrollment options allowing students to enter and exit intervention programs as needed, they may lock students into a tracked path limiting future educational possibilities and diminish perceived locus of control (Buffum & Mattos, 2015). Frequent assessment allows teachers to identify students’ progress and move them to a more appropriate level of intervention if needed. While assessment can equate to assigning grades, teachers should consider their grading practices.

*Grading practices.* You et al. (2016) suggest a positive correlation between self-efficacy beliefs and engagement and grades. Christenson et al. (2012) state that when self-efficacy beliefs are low, engagement is also low and students may earn low grades. However, students may choose not to engage even if self-efficacy beliefs are high and may also receive low grades. Therefore, grades should not be the singular identifier for ability placement (Freed, 2013).

When students receive low grades or when they compare their grades to those of more successful peers, students experience anger, frustration, and rejection (Goetz, Frenzel, Stoeger, & Hall, 2010; Shernoff & Schmidt, 2008). Lewis (2013) notes that these emotions themselves may be short lived, but if they continue for an extended
period, they can establish low mathematics self-efficacy that may affect performance, engagement, and long-term achievement. This reduction of self-efficacy results from student upward comparison.

Consistently receiving low grades can serve as a harsh reminder to struggling students of their low-ability. Gietz and McIntosh (2014) found a strong positive correlation between self-efficacy beliefs and students’ grades and mathematics achievement. After years of failure, rather than attribute their low grades to the tasks falling outside of their mastery experience, students resign themselves to their inability to learn mathematics (Dweck, 2008). Furthermore, low-ability students in heterogeneously grouped classes expect high-ability students to receive the highest grades in the class. They anticipate receiving the lowest grades themselves and come to believe their efforts to earn the top grades are futile and that they cannot learn the mathematics necessary to receive high grades (Trautwein, Lüdtke, Marsh, Köller, & Baumert, 2006). Teachers who target their curricula to a more select group of students with similar ability can also focus grading rubrics on specific targets and standards for the collective ability of that group. Adapting grading allows students the opportunity to receive high grades and compare their performance with their academic peers.

*Adjusting standards.* Students SBGL in mathematics require instruction focused on their needs. Researchers have found that ability grouping enables teachers to assess student ability and then target student needs by identifying the essential standards needed for success (Buffum & Mattos, 2015; Loveless & Brookings Institution, 2008). Duflo et al. (2011) studied students grouped by ability and found that successful teachers taught
fewer but more focused concentrated standards. In doing so, students in low-ability
groups performed better than students in heterogeneous ability groups.

Loveless (2008) states that the expectation that teachers provide equivalent
standards to all students, regardless of ability or understanding, is unreasonable. This
does not imply that teachers should lower expectations of students’ learning ability,
rather that teachers recognize the gaps in understanding previous concepts when
introducing new concepts. Skemp (1978) states that teachers face the challenge of
helping students develop relational understanding within the restricted time available
during the school year. Selecting essential concepts carefully allows teachers to align new
concepts with concepts learned in prior years and establish a foundation imperative for
future coursework.

Norton and D’Ambrosio (2008) state that children create a logical structure of
internalized objects and operations that enhance additional mathematics understanding.
This ties to relational understanding and a posteriori learning as students build and
scaffold future concepts on concepts mastered earlier (Norton & D’Ambrosio, 2008;
Skemp, 1978, 1987). Without internalizing or mastering key mathematics concepts,
students continue to build concepts without proper scaffolding. This leads to confusion,
frustration, and diminished self-efficacy in mathematics encounters. Adapting standards
allows a teacher to select which concepts to develop and link them to prior experience
and understanding.

**Adjust the pace of the curriculum.** A common concern among teachers is time
management and allotment. Wormeli (2006) notes that due to the limited time available
during the school year, all teachers need to determine which standards to introduce and how to allocate time for students to master those standards effectively. Teachers can allot more time to essential standards interwoven with relational understandings if prioritizing those concepts (Wormeli, 2006). Given enough time, all students can identify mathematical links, comprehend the mathematical association, and develop the cognition for mathematical concepts at a meaningful depth of understanding (Bloom, 1974; Burris et al., 2008).

**Confidence.** Researchers have found a positive correlation between self-efficacy, engagement, and confidence (Durksen et al., 2017; Everingham et al., 2017; Li & Lerner, 2013). Bandura (1997) explains the difference between self-efficacy and confidence in that confidence is

> a nondescript term that refers to strength of belief but does not necessarily specify what the certainty is about.... Perceived self-efficacy refers to belief in one's agentive capabilities, that one can produce given levels of attainment. A self-efficacy assessment, therefore, includes both an affirmation of a capability level and the strength of that belief. Confidence is a catchword rather than a construct embedded in a theoretical system. (p. 382)

In other words, confidence applies generally to how a student appreciates his or her ability to work on an assignment where self-efficacy addresses the student’s belief in his or her ability to complete specific tasks successfully. When students’ confidence increases, students’ self-efficacy and engagement also increase. An increase in mathematics confidence may also positively affect students’ attitudes towards mathematics and help students set higher achievement goals (Dogan, 2012). Therefore, when students SBLG in mathematics interact with mathematics content within their ability to succeed with the support of a more knowledgeable other, they can build self-
confidence and consequently increase self-efficacy and engagement. Often, students find the more knowledgeable other amongst their peers in their mathematics class.

**Peer-Curriculum Effect**

How peers react to and interact with curricula is an important influence in the emotional and academic development of middle and high school students. Koenka (2015) notes a strong correlation between grades and self-efficacy when students compare their academic performance to that of their peers. This is depicted in the conceptual framework graphic in Figure 1 by how the curriculum and assessment box passes through the peer effect circle and contains important peer-curriculum influences. Peer-curriculum effect also addresses how students SBGL in mathematics perceive their responsibility for their own learning as well as their responsibility to their peers (H. Marsh & Hau, 2003).

**Perception of mathematics ability.** Peer-curriculum effect recognizes how students react to peers’ interaction with the curriculum. Students compare their ability with other students and conclude that their ability is better than that of other students (comparing downward) or worse than other students (comparing upward). Chiu et al. (2008) note that students in middle school most often compare upward, while Cheung and Rudowicz (2003) state that middle school students compare themselves upward and downward depending on the social situation. While these researchers do not agree on the direction of comparison, they agreed that students understand that they perform either better or worse than other students, but the comparison happens consistently within rather than between assigned classes.

**Within-class/between-class comparison.** Researchers have found that when
students with low mathematics ability recognize obvious differences their academic performance, self-efficacy doubts increase (Wang & Bergin, 2017). Chmielewski, Dumont, and Trautwein (2013) state that this difference is most evident when these students attend class with high-ability mathematics students.

If students perceive mathematics tasks to be excessively challenging and falling outside of the students’ abilities, they withdraw and disengage (Bandura, 2012). There exists, therefore, a need to adjust tasks and curricula to fall within students’ capacity for mastery and facilitate success, higher self-efficacy, and increased engagement. Teachers can align tasks based on student placement. Students can then individually and collectively increase self-efficacy beliefs when they perform equally well or better than their peers, even when those peers attend low-ability classes.

**Peer responsibility.** Students SBGL in mathematics have low self-concepts that often affect their interactions with the mathematics as well as their interactions with their peers. Trautwein et al. (2006) explain the close link between self-concept and the development of self-efficacy beliefs. In 1984, Marsh and Parker conducted a longitudinal study concluding that self-concept correlates with peer comparison and academic performance. They found that equally able students have lower self-concepts when placed in higher ability groups and schools (H. W. Marsh & Parker, 1984) and called the observation Big Fish Little Pond Effect (BFLPE). Replicating the study throughout the world (Kalaycioğlu, 2017; Makel, Lee, Olszewki-Kubilius, & Putallaz, 2012; H. Marsh & Hau, 2003; Nardi & Steward, 2003), researchers have concluded that students form a positive self-image of themselves as good students when comparing their ability to peers
in their designated frame of reference. In other words, students most often compare themselves and their ability with students within the same class rather than students in the same grade or school. More importantly, researchers have found that self-concept and self-efficacy serve as the greatest predictors of long-term mathematics motivation and college course-taking behaviors (Priess-Groben & Hyde, 2017). These researchers align the increased self-concept with enhanced self-efficacy beliefs.

Interestingly, Chmielewski et al. (2013) note that when educators assign high school students to ability groups, low-ability students developed low self-efficacy beliefs. However, the initial drop in self-efficacy changed to increased self-efficacy within approximately two weeks after placement with low-ability peers as students began to compare themselves to others with similar ability (Chmielewski et al., 2013; Fuligni, Eccles, & Barber, 1995; H. Marsh & Hau, 2003). This directly links to two self-efficacy concepts: (a) *Let Me Show You How Smart I Am* and (b) *Let Me Help You*.

First, students within low-ability groups experience the BFLP effect when they become exemplars for their peers (Nagengast & Marsh, 2012). As students SBGL in mathematics take on the roles of *Let Me Show You How Smart I Am* or *Let Me Help You*, they step into the role of more knowledgeable other (MKO) and want to showcase their ability (Goldin, Epstein, Schorr, & Warner, 2011; Rossman, 2013). In heterogeneously grouped classes, students SBGL in mathematics often perceive these roles to be reserved for higher-ability students and do not engage with their peers mathematically (Goldin et al., 2011; Rossman, 2013).

Researchers have found that as students witness other students with like ability
having success in learning the curriculum, their own self-efficacy beliefs increase through vicarious experience (Joët, Usher, & Bressoux, 2011; Schunk & Zimmerman, 2011; Usher & Pajares, 2008). These researchers also found that this increase in self-efficacy beliefs might diminish when students with low ability witness the success of students with high-ability. They compare their ability to the high-level students and believe themselves incapable of reaching the same level.

The peer-curriculum interactions that students who perform SBGL experience may have a positive or negative impact on self-efficacy and engagement. Therefore, educators should carefully consider class composition when enrolling students.

**Peer Effect**

Peer effect differs from peer-curriculum effect in that rather than dealing with how students and peers perceive and react to their comparative academic performance and the curriculum, peers effect relates to social and cultural influences within an academic group (Bandura & Barbaranelli, 1996; Gaddis, 2013; Shim & Finch, 2014; Yonezawa, Wells, & Serna, 2002). These influences are often associated with the placement or combination of the students within the class. The second large circle in Figure 1 represents peer effect and encompasses peer-curriculum effect (as described above) and prosocial/dissocial influences associated with a desire (will) to achieve as well as the placement of students in the class.

As middle school students strive to define themselves socially, they seek validation as individuals and as burgeoning adults (Srull, 2014). At this developmental time, peer effect increases its influence on students’ self-efficacy beliefs and engagement
Middle school students have experienced the effects of cultural capital (Kingston, 2001) and academic habitus (Gaddis, 2013) for many years and have developed self-efficacy beliefs through both academic and social experience in small and larger classroom groups (Rubin, 2003; Shim & Finch, 2014). These ability groups influence social perceptions of students’ inclusion in the class structure.

How students recognize and define their cultural and social relationships with others directly affects their engagement in mathematics classrooms (Gresalfi, 2009). If they compare themselves to high-ability students, they can develop anxiety and low self-efficacy beliefs. If they compare themselves with peers of like ability, students who perform SBGL release some of the academic performance anxiety (Chiu et al., 2008; Chmielewski et al., 2013). Recognizing that their ability is similar to others within the same group, students establish some autonomy, responsibility, and control over their learning.

Sakiz et al. (2012) note that students who experience feelings of belonging, academic enjoyment, and see results of academic effort engage more and achieve more academically. Often, adolescents most in need of academic intervention are seeking approval and support from teachers.

**Prosocial/dissocial peer influences.** Addressing the needs of students SBGL in mathematics with highly experienced teachers, adaptive curricula, amongst like-minded peers can help insecure students feel more accepted. Some students try to hide their ignorance of academic subjects out of fear of ridicule from teachers or peers (Alati, 2011; Rossman, 2013; Sanchez Leal, Schorr, & Warner, 2013; Schenke et al., 2015).
Eliminating the fear associated with social ridicule increases a sense of companionship and support, which can increase self-efficacy beliefs and engagement (Chiu et al., 2008; H. Marsh & Hau, 2003; Yonezawa et al., 2002). Students who perform SBGL in mathematics can ask questions, give examples, and explore new ideas without the social comparison to advanced or even regular-level students who may operate years ahead of them.

**Class environment.** When establishing the culture of a mathematics class, teachers should consider peer interactions as ones that can positively (*prosocial*) or negatively (*dissocial*) influence self-efficacy beliefs and engagement. These interactions may become evident through the participation of the struggling student who may exhibit insecurities by willful negative agentic engagement or by reactive disengagement with the class and the content.

Adolescents who find themselves being judged as intellectually inferior may react dissocially to avoid academic anxiety through their actions (Bandura, 2001, 2002). Students may choose to behave inappropriately when academically overwhelmed and blame the school, the teacher, or the curricula as the root cause (Bandura, 2002). Social context and self-efficacy beliefs link directly to moral disengagement and aggression (Gini, Pozzoli, & Hymel, 2014). Students may generate self-defeating actions or events when they believe the action will positively influence their social standing within the group.

Grouping students with similar dissocial tendencies tends to exacerbate those tendencies and expand to the whole class if left unchecked (Espelage, Holt, & Henkel,
Therefore, educators and programs must address misbehavior to promote self-efficacy and engagement both socially and academically.

**Role model peers.** Respect amongst peers contributes to the academic and social development within mathematics classes and contributes to social performance. Some researchers have found that students in homogeneous low-ability groups may lack prosocial role models (Hanushek, Kain, Markman, & Rivkin, 2001; Mills, 1998a). Goetz, Frenzel, Pekrun, Hall, and Ludtke (2007) state that students with low ability benefit from interactions with student with high ability unless the students with low ability feel useless, frustrated, or incapable. In this case, low-ability students react with apathy, rejection, moral disengagement, and possibly aggression (Bandura & Barbaranelli, 1996; Gini et al., 2014).

Alternatively, educators should create a class structure that fosters behavioral role models from within the low-ability group. When students volunteer answers in class in front of their peers or when they volunteer to help a different struggling student, these practices allow low-ability students to become the behavior and academic exemplars or MKO for their peers.

**Placement.** Historically, many researchers have found placement of students by ability leads to inequity to the access of higher educational opportunities (Boaler, 2015; Levario, 2017; Oakes & Lipton, 1992). With the awareness of access and equity in education, some educators promote the placement of all eighth-grade students in algebra, considered a high-ability course (Bayard, 2012; Domina, 2014; Domina, Hanselman, Hwang, & McEachin, 2016; Schmidt, 2012). Other educators have found this placement
to create maladaptive practices for students ill-prepared for the challenge of high-level mathematics placement (Huang, Snipes, & Finkelstein, 2014; R. Simzar, Domina, Conley, Tran, & Society for Research on Educational Effectiveness [SREE], 2013; R. M. Simzar et al., 2016b). Huang et al. (2014) state, “The consequences of misplacement are most pronounced for students with weaknesses in key foundational areas that support algebra readiness, which frequently translates into difficulty reaching proficiency in higher level math in high school” (p. 3). This research contradicted results by (Raymundo, 2014) who states that the initiative resulted in a rise of ability for all demographics and all ability levels. Regardless of the positionality on the grouping debate, the consideration of placement has impactful results.

Student enrollment into class should consider frequent and ongoing assessment (Buffum & Mattos, 2015; Council, Education, Education, & Committee, 2001b). Additionally, placement should be fluid so that students can move in and out of appropriate interventions as students’ needs change. While grades can indicate a need for an intervention, risk factors, prior engagement practices, and peer influence can also influence need (Buffum & Mattos, 2015; Christenson et al., 2012; You et al., 2016). Grades, therefore, should not be a singular identifier for student placement (Freed, 2013).

**Literature Review of Self-Efficacy Beliefs and Engagement**

At times of changing academic expectations and teacher interactions, student self-efficacy beliefs and engagement often diminish (Gietz & McIntosh, 2014; Usher & Pajares, 2008). Educators attempting to meet the needs of students who perform SBGL in mathematics must consider both social and cultural influences affecting students.
From a review of the literature, the following eight factors influence students’ mathematical needs: (a) teachers and how they enact their curricula (Collins & Gan, 2013; Duflo et al., 2011; Gamoran, 2009b), (b) students’ sense of belongingness (Shim & Finch, 2014), (c) students’ sense of bullying (Gietz & McIntosh, 2014), (d) peer support (Freed, 2013; Hanushek et al., 2001), (e) students’ sense of control (Sakiz et al., 2012), (f) students’ cultural ethnicity (Brown, Collins, & Duguid, 1989), (g) students’ SES (Carmona, Wheelock, First, & National Coalition of Advocates for Students, 1998), and (h) students’ home environment (Brown et al., 1989; Coutinho & Oswald, 2017; John-Steiner & Mahn, 1996).

Table 1 shows how five of these eight influences align with the four class structure factors included in this study: (a) teacher effect, (b) teacher-curriculum effect, (c) peer-curriculum effect, and (d) peer effect.

In addition to experiences with puberty, relationships with authority, and new peers’ structures, middle school students experience larger class sizes, multi-class

Table 1

**Alignment of Eight Factors to Four Teaching Effects**

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<tr>
<th>Four effects</th>
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<tr>
<td>Teacher effect</td>
<td>Teachers and how they enact their curricula through the relationship developed with the student</td>
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<td>Teacher-curriculum effect</td>
<td>Teachers and how they enact their curricula and the expectations of performance with the concepts</td>
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<td>Peer-curriculum effect</td>
<td>Students’ sense of control as they enact the curricula</td>
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<td>Peer effect</td>
<td>Students’ sense of belongingness. Students’ sense of bullying</td>
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schedules, and changes in teacher expectations (Anderman, 1994; Urdan, Midgley, & Wood, 1995; You et al., 2016). At this time, four factors—(a) teacher effect, (b) teacher-curriculum effect, (c) peer-curriculum effect, and (d) peer effect—directly influence self-efficacy beliefs and engagement as described in the conceptual framework section. This researcher will first address self-efficacy and how students develop and experience self-efficacy. Then, the researcher will present a connection between self-efficacy and engagement. Last, the researcher will discuss mathematics engagement.

**Four Sources of Self-Efficacy**

Bandura (1997) states that students derive self-efficacy beliefs from four main sources (see also Joët et al., 2011; Lunenburg, 2011; Schunk & Zimmerman, 2011; Usher & Pajares, 2008). These sources include (a) physiological and/or emotional states, (b) achievement experience or past performance, (c) verbal persuasion, and (d) vicarious experience. How students develop self-efficacy varies based on students’ personal standards as influenced by their gender, social experience, and classroom structure. The following sections address the four main sources of self-efficacy: physiological and/or emotional states, achievement experience or past performance, verbal persuasion, and vicarious experience.

**Physiological and/or emotional states.** Elementary students SBGL in mathematics often interpret anxiety, fear, stress, and fatigue as their inability to do mathematics. Consistent failure in mathematics can trigger these responses (Lunenburg, 2011). Although physiological and emotional responses and maturity vary greatly by gender and ethnicity, anxiety, fear, stress, and fatigue seem to diminish as students reach
middle school and high school (Joët et al., 2011). The teacher can foster positive emotions of potential success through the teacher effect when expressing belief that the students can learn and succeed with grade-level content. The teacher-curriculum effect can also mitigate negative physiological responses when providing a classroom support structure with curriculum and peers that help students successfully complete grade-level mathematics tasks.

**Mastery experience or past performance.** Closely linked to physiological or emotional states is how the student perceives current ability based on his or her evaluation of prior success. If, based on failed past performance, students believe their current efforts will be futile; they will have less motivation and lower levels of perseverance in completing tasks. Schunk and Zimmerman (2011) state that a climate that emphasizes mastery can positively motivate students as they develop confidence given achievable and clear expectations. In order to provide attainable mastery goals, the teacher may need to adjust the grade-level curriculum (teacher-curriculum effect) to fall within the students’ ability to succeed.

**Verbal persuasion.** As students interact with others, they give and receive cues about their ability to complete a task. Scholars speak against labeling students as SBGL in fear of students developing low self-concept and self-efficacy beliefs (Boaler, 2015; Burris et al., 2008). By ninth grade, however, students SBGL in mathematics have struggled for years as the mathematics challenges compound. Hudak and Kiln (2014) write that labeling students is much more complex than stating that a student lacks ability. Labeling can have devastating academic results when the labeling exploits a
student or restricts or limits a student’s future. Teacher effect and teacher-curriculum effect should consider labeling a student SBGL as an identification of students in need of extreme interventions that will fill gaps and deficits in mathematics understanding, not as a process to lock a hopeless student into a predestined educational track.

Teacher and peer effects can greatly influence students in convincing students that they can succeed in a given mathematics task. In order for the persuasion to succeed, the feedback must be genuine, specific, and focus on effort over ability (Joët et al., 2011). As students recognize that they can succeed using specific actions and interactions as described by the teacher or peers, the students can establish longer-lasting goals to perform on grade level.

**Vicarious experience.** Students often adjust their beliefs about their own ability to succeed based on the success or failure of others around them. Verbal persuasion and vicarious experience may have the greatest effect self-efficacy beliefs, especially for female students (Schunk & Zimmerman, 2011). Furthermore, students SBGL in mathematics’ self-efficacy positively changes more if their performance is on par or better than the performance of their peers (Usher & Pajares, 2008). If the ability of the peers in the class is close to the ability of the student, then the student has a higher probability of equal or better comparative achievement (Chimielewski, Dumont, & Trautwein, n.d.; Chiu et al., 2008; Schunk & Zimmerman, 2011). Vicarious experience relates to the success found in BFLP experiments (Chimielewski et al., n.d.). In other words, students develop greater self-efficacy when they see the success of students with similar ability.
Peer-curriculum effect addresses how peer students react to the enacted curriculum whether receptive or successful. Peer effect considers the motivating influence of peers akin to *Let Me Help You* and *Let Me Show You How Smart I Am* (Goldin et al., 2011; Rossman, 2013). As students observe peers succeed, they build greater self-efficacy beliefs in their own ability.

**The Relationship Between Self-Efficacy and Engagement**

Researchers have identified social and cultural positive and negative changes that occur in middle school and affect self-efficacy and engagement. Furthermore, scholars have substantiated a positive correlation between self-efficacy and engagement (Christenson et al., 2012; J. A. Fredricks, Blumenfeld, & Paris, 2004; E. Kennedy, 2009; Rossman, 2013; Usher & Pajares, 2009; You et al., 2016). When self-efficacy lowers, engagement also declines. Conversely, students who do not engage with academically-minded students may (but not necessarily) develop diminished self-efficacy (Christenson et al., 2012). Students who perform SBGL in mathematics have often spent many years in this downward spiral and have become socially and academically disengaged.

The inverse is also often true. When students believe in their ability to accomplish a task, they may (but not necessarily) more readily engage with mathematics. Engagement helps develop confidence that leads to proficiency and academic success. This, in turn, may bolster self-efficacy beliefs and may increase academic success (Christenson et al., 2012; Council et al., 2001a; E. Kennedy, 2009; Parker et al., 2014).

However, when self-efficacy rises, engagement may not increase (Christenson et al., 2012; Watt & Goos, 2017). Scholars have shown that increasing engagement
positively increases self-efficacy beliefs (E. Kennedy, 2009; Martin, Way, Bobis, & Anderson, 2015). However, a student may recognize his or her mathematics ability but choose not to engage with the mathematics. Therefore, grades, attitude, and engagement are not sufficient indicators to determine a student’s poor academic achievement or ability (Freed, 2013).

Social, affective, and motivational factors not only influence learning, they form the learning process through which students incorporate learning (Gresalfi, 2009). The cultural and environmental structure of the mathematics classroom strongly mediates these factors. Thus, teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect act as primary factors when investigating these relationships between students’ self-efficacy and engagement.

**Identifying Self-Efficacy Beliefs and Engagement**

Researchers have found that self-efficacy beliefs and engagement contribute to students’ identities in mathematics (Watt & Goos, 2017) and engagement is the key to learning (Goldin et al., 2011). Ninth-grade students SBGL in mathematics experience diminished self-efficacy after years of low performance and disengagement (Lunenburg, 2011). Teachers may reverse the effects of low self-efficacy from years of below-grade level performance at the possible expense of students receiving a lower-level curriculum.

In an interview with Frank Parjares, Bembenutty (2007), quotes,

Teachers have the responsibility to nourish and protect the self-efficacy beliefs of their students. The aim of education should always transcend the development of academic competence. Schools have the added responsibility of preparing fully functioning and resilient individuals capable of pursuing their hopes and their aspirations. To do so, they must be armed with optimism, confidence, self-regard,
and regard for others and they must be shielded from unwarranted doubts about their potentialities and capacity for growth. (p. 11)

Balancing the need to develop self-efficacy with essential elements of a mathematics core, however, is very difficult. Researchers cannot accurately infer a student’s motivation or intention through observation or survey (Shernoff & Schmidt, 2008), and correctly ascertaining engagement is also challenging. Researchers have, however, identified four main types of engagement: (a) cognitive engagement, (b) behavioral engagement, (c) emotional engagement, and (d) social engagement.

Cognitive Engagement

Researchers define cognitive engagement as how students think and process information (J. A. Fredricks et al., 2004; Linnenbrink, 2007). Evidence for cognitive engagement includes the motivation students have for setting and achieving learning goals (E. Kennedy, 2009). Researchers can infer cognitive engagement from students who verbalize their thoughts, exchange ideas, and ask and answer questions. Researchers, however, might also characterize these same actions as behavioral engagement (Christenson et al., 2012).

Although difficult to identify positively, evidence exists that defeatist self-efficacy beliefs and negative self-image undermine cognitive engagement and limit learning (Christenson et al., 2012; Sanchez Leal et al., 2013). Students who have developed negative ability and expectancy beliefs disengage from mathematics classes and increase self-sabotaging behaviors (Bowers & Sprott, 2012b; Bowers, Sprott, & Taff, 2012; Christenson et al., 2012). Students that experience stress, social challenges, academic challenges, and negative peer interactions exhibit reduced cognitive
engagement (Christenson et al., 2012). If educators can mitigate these experiences, students can progress more rapidly to set and possible achieve higher academic goals.

**Behavioral Engagement**

Kennedy (2009) defines behavioral engagement as the “level of participation or involvement that a child invests in a given activity” (p. 2). Students exhibit behavioral engagement when they participate in class, adhere to class norms, listen to instructions, take notes, answer questions, and exert effort and persistence to accomplish a task (J. A. Fredricks et al., 2004; Linnenbrink, 2007; Rossman, 2013).

An observer cannot truly know whether the student engagement is behavioral, cognitive, emotional, or social because observers are not privy to students' inner thoughts and motivations. Neither can the observer know the extent to which their actions reflect engagement or simple compliance with instructions (J. A. Fredricks et al., 2004; Shernoff & Schmidt, 2008). Shernoff and Schmidt note that high school students self-reported participating in class, adhering to class norms, following instructions, taking notes, and answering questions. They then admitted that they were not actually engaged in learning. Their actions indicated school engagement, but in reality, their actions were often non-academic.

Actions may signal engagement, but emotions also influence the kind and level of engagement. Pleasant emotions do not necessarily affect behavioral engagement, but strong evidence indicates that unpleasant emotions negatively affect behavioral engagement (Linnenbrink, 2007). Researchers that can identify whether behavioral engagement is positive or negative could more easily evaluate the effect of a class
structure on behavioral engagement.

**Emotional Engagement**

Emotional engagement involves the affective responses to learning activities and varies widely ranging from demonstrations of happiness to sadness, excitement to boredom, enjoyment to frustration, and may involve anger and anxiety (J. A. Fredricks et al., 2004; E. Kennedy, 2009). Educators may misconstrue these emotions as behavioral or cognitive and implement behavioral or cognitive interventions (Buffum & Mattos, 2014; Duffy, 2007). When trying to analyze engagement behaviors, researchers should determine the type and cause of engagement in order to understand the reactions and intentions of the student.

Students’ perceptions of their own competence enhances emotional engagement (J. A. Fredricks et al., 2004). When students lack ability and expectancy beliefs, their emotional engagement positively correlates with those beliefs. By moving students into an appropriate ability level group, they may develop stronger ability and expectancy beliefs and increase positive emotional engagement (Christenson et al., 2012).

**Social Engagement**

Social engagement addresses how social interactions impact learning and learners (Christenson et al., 2012). Students who engage socially negotiate their identities with communities of practice (Hickey & Zuiker, 2005). Researchers have investigated two important factors in social engagement in the mathematics classroom: teacher-student and student-student interactions (Duflo et al., 2011; Hanushek et al., 2001; McLouglin, 2009; Roeser, Midgley, & Urdan, 1996; You et al., 2016). Gresalfi (2009) observed teacher-
student and student-student discourse in two different middle school mathematics classes and reported how supportive social interactions help increase self-efficacy beliefs and engagement. She found that when teachers fostered a greater sense of community among the students, they learned to depend upon each other. In turn, those students may develop the courage to engage with the mathematics (Lampert, 1990). The class structure can directly affect social engagement either positively or negatively and can influence learning outcomes.

**Positive/Negative and Active/Passive Engagement**

In addition to the four types of engagement listed above, students may engage with mathematics and a classroom structure positively or negatively (Fischer, 2005; J. Fredricks et al., 2011). J. Fredricks et al. (2011) categorize engagement as positive when students are engaged in work like playing an academic game, or asking or answering mathematics questions. They describe negative behaviors as those that disrupt the class or when students inappropriately interact with other students.

Furthermore, J. Fredricks et al. (2011) also noted the importance of the difference between observed passive versus active engagement indicators. Some engagement indicators may be characterized as passive or as active. For example, if a student pretends to sleep in class, the action is passive if the student is bored or tired. If the student’s intent is to be defiant or show contempt, the same action is active. The determination between positive/negative and active/passive engagement indicators can be challenging to distinguish and may be left to the subjective interpretation of the observer.
Conclusion

Administrators and teachers strive to meet the needs of students who perform SBGL in mathematics and can focus on the organization, structure, and composition of mathematics classes. Organizing mathematics classes reflective of sociocultural interaction only improves learning when the group dynamic supports meaningful participation and practice to achieve the mathematics learning goals (Hickey & Zuiker, 2005). The structure of the class must consider the social dynamic of the group and as well as the implemented curriculum.

Placing students who perform SBGL in mathematics in an environment designed to meet their needs allows them to participate and interact within their areas of potential success. This means that a structure that addresses teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect may improve students’ mathematics self-efficacy beliefs and mathematics engagement.
CHAPTER III

METHODS

The purpose of this study was to examine how aligning teacher quality, peer support, and appropriate curriculum affected the self-efficacy beliefs and observable engagement indicators of ninth-grade students who perform substantially below grade level (SBGL) in mathematics. The researcher gathered qualitative and quantitative data over a four-month period using a QUAL + quan convergent parallel mixed methods case study design (Creswell, 2013).

The study took place in three phases: Phase I Pre-implementation, Phase II Implementation, and Phase III Post-Implementation. The pre-implementation phase defined the participants on whom the researcher focused the study and the initial evaluation of students’ self-efficacy and engagement in mathematics from surveys and interviews. The implementation phase concentrated on the observations in the classroom and interviews with students after those observations. The post-implementation phase provided data from post-implementation interviews and surveys.

Research Questions

This study examined whether providing a class that focused on essential concepts and skills with additional instruction support would increase students’ self-efficacy beliefs and their engagement indicators in mathematics that in turn may also increase mathematics assessment scores for low-ability students.

This study was guided by an overarching research question: “How does
addressing the needs of middle school students SBGL in mathematics by aligning teacher quality, peer support, and appropriate curriculum affect the students’ self-efficacy beliefs and engagement in mathematics classes?” To address this overarching question, this researcher focused on how students responded to a specific class structure and systems of support (Palinkas et al., 2015). This study’s objectives addressed the following three research questions.

1. How do students SBGL in mathematics exhibit observable engagement, if any, when teacher, curriculum, and peer focus align with their academic needs?

2. What self-efficacy indicators, if any, emerge in mathematics classes when teacher, curriculum, and peer focus align with the academic needs of students SBGL?

3. How do self-efficacy beliefs and observable engagement indicators change when addressing teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect that focus on the academic needs of students SBGL?

**Research Design**

The research designed used in this study was a QUAL + quan convergent parallel mixed methods case study (Creswell, 2013). This designed allowed for an analysis of qualitative and quantitative data and explored teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect on the self-efficacy and observable engagement indicators of ninth-grade students who perform SBGL in mathematics. Collins, Onwuegbuzie, and Jiao (2007) note that this type of mixed methods research design allows the researcher to observe students as they interact cognitively (asking or answering questions), behaviorally (complying with instructions reacting to classroom norms), emotionally (signs of depression, happiness, etc.), or socially (interacting with
The researcher took a postmodern approach to the study in that she challenged some researchers’ beliefs that grouping students by ability harms those students psychologically and educationally (Boaler, 2008; Boaler, Wiliam, & Brown, 2000; Burris et al., 2008; Mills, 1998b). The epistemological lens addressed the social aspect of cognitive development as well as the socio-cultural aspects of classroom structure (Bandura, 1993; Daniels, 2016; Watt & Goos, 2017). It also enabled the researcher to examine the social and cultural influences of teacher, curriculum implementation, and peers upon students’ self-efficacy beliefs and observable engagement indicators in mathematics.

**Selection of Participants**

The researcher selected three groups of participants to observe, interview, and survey in this study: (a) the teacher group, comprised of the teacher and a paraprofessional, (b) the class as a whole, observed by the researcher, and (c) a group of five students, observed more closely throughout the study. In the following section, the researcher will discuss the selection of the participants during Phase I Pre-Implementation.

**Teacher Selection**

This researcher centered the study on a ninth-grade class taught by Ms. Green, a highly-qualified teacher (state certified, level two educator with a level four mathematics Bachelor of Science from an accredited university). The teacher adapted the ninth-grade
curriculum in to address the learning gaps of students who perform four or more years below grade level in mathematics. The four factors recognized in the study to meet those needs were (a) teacher effect, (b) teacher-curriculum effect, (c) peer-curriculum effect, and (d) peer effect.

The school also hired a paraprofessional to help with class management and instruction. The paraprofessional had 11 years of general experience as a teacher’s assistant and two years’ experience working in this essential standards’ class (ESC) structure. The classroom teacher met with the paraprofessional weekly to discuss the paraprofessional’s role in the class, interactions with students, on-going qualitative assessment of students, and other management and assistance needs in the classroom. This collaboration enabled consistent teaching interactions with students, a necessary element for a class of possibly unmotivated students that could act aggressively or dissocially (Bandura & Barbaranelli, 1996; Espelage, Holt, & Henkel, 2003; Shin & Raudenbush, 2011).

**Class Participants**

Of the 24 students in the class, 23 students returned permission forms allowing participation in the study. Of those 23 students, 19 participants completed both the pre- and post-implementation survey. Two of the 23 students transitioned out of the class to a regular-level class. Two of the 23 were absent for the two weeks of the post-implementation survey.

Within the first two weeks of term one, the ninth-grade teachers at the school administered a pre-assessment to all of the ninth-grade students to gauge mathematics
ability See Appendix C: Pre-Assessment Selection Tool). The teachers then analyzed the history of students who scored in the lowest 10% considering past pass/fail rates for prior years, behavior in their prior mathematics classes, and work ethic in their prior mathematics classes. Of these bottom 10%, teachers recommended students who had failed multiple terms of mathematics, had low scores on their state mandated year-end assessment, demonstrated effort in their mathematics classes, and who exhibited prosocial behaviors in their classes. Teachers then consulted with students and parents to consider a change into this class. The researcher did not select which students enrolled in this class other than recommending students from her own ninth-grade classes attending this school. Inclusion in the class did not determine whether a student enrolled in the study.

Although educators generally enrolled students in this class based on the assessment criteria explained above, counselors had previously enrolled nine students in the class at the end of their eighth-grade year based on their eighth-grade teacher’s recommendation. After administering the pre-assessment, the ninth-grade teachers considered teacher, parent, and student feedback of those pre-enrolled students who performed significantly higher than others recommended for the class. Five of the nine students qualified to remain in the class and two students transferred into a regular-level mathematics class.

Ms. Green made an exception for two students later classified as high-comparative ability for this study. One of these students experienced high anxiety when in a regular-level class and parents, teachers, counselors, and administration decided that
he could develop a greater sense of self-efficacy if he remained in this class. The other student’s parents demanded that he remain in the class, disregarding the classroom teachers’ placement recommendation. No other exceptions occurred during the enrollment process.

When this study began, 25 total students had enrolled in the class. This ESC contained 18 boys and seven girls. By term three, educators had enrolled four new students into the class and two students who initially participated in the student survey had moved into regular-level classes for a total of 27 students in the class chosen for the study. Students added after the participants had completed the initial survey and observations were not included in the study.

There were 23 students who agreed to participate in the study, seven female and 16 male. By the end of the study, teachers had moved two of the 23 participating students (one girl and one boy) into a regular-level class, and two students were absent for three weeks and excluded from the study. In total, 19 students provided pre- and post-implementation data for the quantitative portion of the QUAL + quan convergent parallel mixed methods case study.

**Students Selected for Observation**

The researcher initially selected six students from the class to observe, video record, and interview, (two each) of high, middle, and low-comparative levels of mathematics ability. The researcher based the student categorization of high, middle, and low ability students on the following four criteria: (a) feedback from the teacher the students had in term one, (b) current participating teacher recommendation, and (c) ninth-
grade pre-assessment scores.

Although the researcher chose two students of high-comparable ability to begin the study, after approximately one and one-half months, the teachers, the parents, and the student agreed that one of these students had become proficient enough in his mathematics ability to be successful in a regular-level mathematics class. When he transferred to this other class, he was dropped from the study. A review of this student’s survey, interview, and first observation data provided similar information as the other five students selected for closer study. Therefore, due to the time that had pass in the study as well as the fact that this student was likely to be very similar to the other students who completed the study, this student was not replaced in the study when his class change occurred.

Observing and interviewing these students allowed the researcher to gather qualitative data including the behaviors of students in class, their interactions with the teacher and their peers, and the students’ explanation of their feelings about the class. These observations, recordings, and interviews provided qualitative data to analyze the relationship between student changes and (a) teacher effect, (b) teacher-curriculum effect, (c) peer-curriculum effect, and (d) peer effect.

*Students with high comparative ability.* The eighth-grade teacher chose two students who she intimated performed well in the eighth-grade ESC. Henry scored 12 of 20 on his ninth-grade pre-assessment and Hayden scored 15 of 20. These scores fell into a range average or high compared to the scores of average ability level ninth-grade students in the school. Because the pre-assessment test revealed that both students
performed much higher than the norm of the students in this ESC class, the researcher asked the classroom teacher why these students still attended this level class.

Hayden had exhibited negative self-concept indicators relating to school in general, not just to mathematics. Teachers and counselors reported these indicators as not doing homework, refusing to work in class, expressed anger about assignments and about mathematics. Ms. Green stated that counselors and parents felt that the ESC placement helped him develop the confidence to participate in class, to work at the board, and to work as an exemplar for other students in the class. He had developed characteristics of a role model and other students turned to him regularly for help.

About 1 month after commencement of the study, Henry expressed the desire to transfer to a regular-level class. The teacher and paraprofessional agreed and counselors enrolled him in a regular-level class mid-term, and the researcher dropped this student from the study. From this point forward, the researcher will refer to the students selected for observation and interviews as the five selected students.

*Students with average comparative ability.* Two boys, Marco and Mason, were selected for observation and enrolled in the class at the beginning of term two. Marco scored a 3 out of 20 and Mason scored a 5 out of 20 possible on their ninth-grade pre-assessments. Both had continued to struggle at their regular-level class in spite of having a supplemental class period that met daily for mathematics instruction and were transferred to the ESC in term two after failing term one.

*Students with low comparative ability.* The researcher selected two students with low comparative ability: a girl, Lacey, and a boy, Lincoln. Lacey scored a 4 out of 20 and
Lincoln scored a 0 out of 20 possible on their pre-assessments. Although Lacey had scored a point higher than Marco had on the pre-assessment, the participating teacher explained that her observation and experience with Lacey on the short term led her to believe that Marco’s ability and capacity to learn the material exceeded Lacey’s ability. Ms. Green expressed that Lacey would be a better “low-comparative ability” candidate for this study. Their regular-level teachers had recommended them for the ESC for term two after they had failed term one.

**Setting**

This study took place at a very large middle school (over 2200 students) in the intermountain west. Internet demographic information reports the school as located in a mid-socioeconomic suburban community where approximately 18.50% of the students qualify for free or reduced lunch. Approximately 85.50% of the students are Caucasian, 7.90% of students are Hispanic and 6.60% of the students make up other racial categories. Observation of the class reflects this same general demographic make-up as the school with possible slightly higher Hispanic ratio of 13.04% or three Hispanic students. The teacher explained that this may be due to the transient nature of the Hispanic population in the school and that many of these Hispanic students transfer to this school with below grade-level mathematics ability. However, the teacher also reported that the teachers evaluate all transfer students’ abilities and they base enrollment in the class on this testing. Language challenges do not automatically signal a need for enrollment in the ESC.

This middle school houses grades seven through nine, a common middle school
configuration in this state. The school provided all mathematics teachers with adequate
teaching supplies (e.g. markers, paper, Smartboards, projectors, document cameras).
Before the beginning of the study, the researcher secured permission from the principal of
the school as well as the district supervisors to conduct the study. She informed these
leaders how she would keep data confidential and that participating individuals would
receive pseudonyms for any publication.

The school operated on an A/B block schedule meaning that students attend four
classes each day for 80-minutes each. This class met during the third period of the day
between 11:35 and 1:25. Students attended the second of three half-hour lunch breaks.
The classroom teacher requested that this class meet during the third period so that the
lunch break assigned to these students fell in the middle of their class affording the
students a break in the class.

The ninth-grade teachers at this school developed their own curriculum aligned
with the state adopted ninth-grade common core state standards for mathematics
(CCSSM). The teachers collectively designed a blueprint document to establish essential
standards necessary to prepare ninth-grade students for the tenth-grade curriculum the
following year. Distinguishing the essential (or crucial) standards from non-essential (or
extension) standards provided a framework for the planning and teaching for this
essential standards class (ESC) for mathematics.

The ESC followed a scope and sequence similar to that of the regular-level ninth-
grade mathematics classes (see Appendix D). The units for the ESC included guided
notes (e.g., Appendix I) for the students to follow in class, homework assignments (see
Appendix F for a comparison of the ESC homework to homework from the regular-level class), and a mastery assessment at the end of each unit (see Appendix G for a comparison of the competency assessments between the ESC and a regular-level class).

Data Sources and Instruments

The researcher used four data sources throughout the study: (a) a pre- and post-implementation semi-structured interviews with the classroom teacher (Appendix L), (b) semi-structured pre-, mid-, and post-implementation interviews with each of the five selected students (Appendix K), (c) six observations of the class with memos and recordings (video and audio) focused mainly on five students selected during the study (see Appendix H for Observation Protocol), and (d) quantitative pre- and post-implementation surveys of the class participants (Appendix J). The researcher describes these instruments and their development in detail in the following sections.

While several researchers address similar topics with larger data sets, few had multiple data types (Alati, 2011; Durksen et al., 2017; Rossman, 2013; Wang, Fredricks, Ye, Hofkens, & Linn, 2016). Yin (2013) recommends adjusting the number of participants based on the complexity and narrowness of the study. This study used a broad approach to include multiple instruments and data sources.

Teacher Interview

The first data source was the pre and post semistructured interviews with the teacher. The interview protocol included eight questions (see Appendix L). The questions centered on the teacher’s perspective of how to evaluate and place students in this ESC,
the students’ mathematics understanding, and her experience with students SBGL in mathematics. The interview was designed to last approximately 15 minutes. The researcher provided Ms. Green with a copy of the questions on the interview protocol in advance to allow time for reflection before the interview.

The post-implementation interview included more questions that emerged over the course of the study. The researcher asked additional questions about the specific students and observations of the students during the study. These open-ended questions allowed the classroom teacher to discuss her impressions and her own observations about events, students’ self-efficacy, and engagement.

The teacher interviews were designed to provide a subjective perspective of observable engagement indicators throughout the study, including changes in self-efficacy and engagement indicators. Because Ms. Green has taught the class for several years, her subjective perspective provided insight of a longitudinal nature. Her responses also revealed the passion she has for the ESC and its effect on students SBGL in mathematics.

**Student Interviews**

The second data source came from four sets of student interviews with the five selected students: one pre-implementation interview, two implementation interviews, and one post-implementation interview. The pre-implementation interview protocol included nine questions (see Appendix K). The implementation interview questions included these protocol questions, but included additional questions arising from the observations. The post-implementation interview questions arose from the observations as well as questions
reflective of the ESC and the study’s research questions. The researcher recorded and transcribed each interview. The transcriptions of the interviews allowed the researcher to code the responses and to infer the emotional and social tone of the indicators associated with the students’ engagement.

The researcher developed the pre-implementation interview protocol by adapting semistructured questions from a self-efficacy study of college students in an engineering class (Burnham, 2011) intending that these questions might reveal self-efficacy beliefs of the students about mathematics. Suggested by Creswell (2013), the questions included open responses, allowing the students to express their opinions about mathematics, performance, and their own actions during class rather than limiting responses to closed-ended quantifiable data.

The researcher designed the two student interviews during the implementation phase to last approximately 20 minutes. These two sets of interviews after the observations of units four and six allowed the student participants to explain or expand upon actions memoed during the observations, and to comment on their levels of self-efficacy and engagement.

The post-implementation interview lasted approximately 20 minutes and the student participants reflected on their experiences in the ESC as well as their self-efficacy and engagement. The five students also expressed their beliefs about their future expectations in the coming year.

The questions that arose from the observations in this semi-structured format allowed the students to express additional insight into their impressions about the class
and their engagement indicators. The data from these student interviews provided qualitative data to analyze and compare with the teacher interviews and classroom observations as well as the quantitative data from the surveys.

Observations

The third data source included the researcher’s observation memos and recordings of the six class observations where the researcher tracked observable engagement indicators of the five selected students (Appendix H). The researcher conducted three sets of observations, two each during units four, six, and nine. Memoing provided information about tension, excitement, peripheral events, actions, and emotions in the classroom that she felt influenced her interpretation of classroom activity (Creswell, 2013). Memoing included descriptions of the room, participants, flow of the lesson, notes about the lessons, insights into student-student and student-teacher interactions, and classroom norms and structures. The researcher recorded (audio and video) the six observations. Three sets of two observations each provided notes from the observation protocol, memos of the observations, and codings from audio and video recordings of the observations. Together, these observations provided a more subjective view of the self-efficacy and engagement indicators. They also allowed the researcher to interpret in situ the behaviors of the students to gauge any observable changes in those indicators.

For the first observation, the researcher used the observation protocol (Appendix H) to note general class engagement indicators, energy of the room, interruptions to the class or lesson, and activity during the class. The observation protocol allowed for notation of observable engagement indicators with physical actions or verbal expressions
in four general categories: student with the teacher, student with their peers, student using class tools (such as rulers, calculators, pencils, etc.), and student alignment with class structure (rules, procedures, policies, etc.). The researcher attempted to note events for each of the five students observed in the first observation as well as maintain audio/video equipment and list times of each of the events.

Student Surveys

The fourth source of data was student surveys to assess and target students’ self-perceptions and beliefs about their engagement and motivation before and after the implementation of the intervention. The items in this survey came from two sources: a quantitative study that developed an instrument to measure mathematics self-efficacy and anxiety (May, 2004) and a mixed-methods study that developed an instrument to measure the four categories of engagement: cognitive, behavioral, emotional, and social (Wang et al., 2016). While these surveys originally addressed mathematics and science courses in general, this researcher eliminated the science references in the questions by altering the original items in the survey to reflect only mathematics.

Self-efficacy survey. May (2004) developed the Mathematics Self-Efficacy and Anxiety Questionnaire (MSEAQ) instrument in a study on the importance and development of an instrument to test self-efficacy and anxiety in science and mathematics. May evaluated the self-efficacy and anxiety items and responses together and separately. The self-efficacy subscale returned a Cronbach’s Alpha of .94. May asserts that if coupled with other tools like interviews and observations, that researchers can, in part, use self-reporting to determine self-efficacy beliefs (see also Fredricks and
The Cronbach’s Alpha for the self-efficacy items revealed that one of the 14 items (“I believe I can think like a mathematician”) did not yield the results as anticipated. The Cronbach’s Alpha for the remaining 13 items about self-efficacy measured the internal consistency of the MSEAQ at .93. These items closely aligned with those for the 2016 pilot study and therefore the researcher adopted them for this study’s student survey.

Engagement survey. Wang et al. (2016) developed the Math and Science Engagement Scale (MSES) instrument at the University of Pittsburgh. They created this instrument specifically for middle school and high school mathematics and included 33 items. The MSES measures the results of self-reported mathematics engagement to include cognitive, behavioral, emotional, and social engagement questions. As in the self-reporting of self-efficacy, Fredricks and McColskey (2012) note that self-reporting of engagement may also accurately depict true student engagement when coupled with other forms of evaluation like observation and interviews. In this case, Wang et al. (2016) confirmed item results by correlating responses with teacher interview responses to the same survey questions about their students.

Wang et al. (2016) sampled 3883 sixth through 12th graders of diverse racial demographics in six urban school districts. Students rated their engagement on a 5-point sliding scale in this online survey during regular mathematics and science class times. Each of the 65 mathematics or science teachers then conducted open-ended interviews with five students randomly selected by the researchers. After comparing student responses with teacher responses, the researchers finalized these 33 survey items. Each of
the 33 items analyzed fell within range of acceptance to use as part of this study (Wang et al., 2016). The 33 items were comprised of sets of questions about the four engagement types: cognitive, behavioral, emotional, and social. The survey developers calculated the averages of each of these sub-categories of engagement questions and calculated a Cronbach’s Alpha for each type. This researcher included the Cronbach’s Alpha measures for each category of engagement in Table 2.

The researcher administered the survey to all participating students in the class to gather data about the general feelings about mathematics self-efficacy, engagement, and participation in this ESC. Surveying the entire class provided descriptive statistics from a sample group to use for statistical evaluation with paired sample t-tests and ANOVA tests. The following section describes how the researcher conducted the procedures and data collection process.

**Procedures and Data Collection**

The study took place in three main phases (a) pre-implementation: selection of the participants, pre-implementation interviews with the students and participating teacher,

<table>
<thead>
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<th>Engagement type</th>
<th>Self-reported</th>
<th>Teacher reported</th>
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</thead>
<tbody>
<tr>
<td>All engagement items (n = 33)</td>
<td>.93</td>
<td>.97</td>
</tr>
<tr>
<td>Cognitive engagement (n = 7)</td>
<td>.75</td>
<td>.93</td>
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<tr>
<td>Behavioral engagement (n = 8)</td>
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<tr>
<td>Social engagement (n = 8)</td>
<td>.74</td>
<td>.86</td>
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</table>
and the initial data from the pre-implementation survey of the class participants, (b) implementation: the gathering of qualitative data from classroom observations (two each of three units), and two sets of student interviews, and (c) post implementation: the gathering of the final data for analyses (post-implementation class survey and post-implementation interviews with the students and participating teacher). The following section outlines the phases of the study.

Organizational Flow

Figure 2 outlines the flow of the data gathering during the three phases of the study.

The pre-implementation phase included the selection of the class participants, the pre-interviews of the five selected students, the teacher pre-interview, and the students’ pre-implementation survey. During the implementation phase, the researcher conducted six class observations (two each of three units over 4 months) and two sets of student interviews. The researcher conducted Phase II interviews after each set of observations of Unit 4 and Unit 6. During the post implementation phase, the researcher

![Figure 1. Phases of the design of the study. This figure outlines the elements of the three phases of the study.](image-url)
administered the students’ post implementation survey to the class participants, conducted the post-implementation interviews of the five students after unit 9, and conducted the post-implementation interview of the participating teacher.

**Data Collection**

The researcher conducted the coding and analysis throughout the three phases. The researcher gathered qualitative data from observation memos, interviews, and videos of the observations. The codes from these data sources informed questions that the researcher asked in subsequent interviews. The researcher gathered quantitative data from the students in the class who completed a 46-question survey addressing self-efficacy and engagement.

**Phase I: Pre-implementation.** The pre-implementation phase served to select the students who would participate in the study and to gauge potential patterns and codes relating to their self-efficacy beliefs and their engagement indicators. This researcher set this baseline using the teacher pre-implementation interview, the students’ pre-implementation interviews, and the students’ pre-implementation survey results.

**Teacher pre-implementation-interview.** Prior to the start of the study observations, the researcher conducted a semi-structured teacher interview. This interview allowed the researcher to assess the teacher’s opinion of the class structure and of teacher effect and teacher-curriculum effect. This interview also provided additional insight into observations and behaviors that she had observed in the class to that point.

**Students’ pre-implementation interviews.** This researcher conducted pre-implementation interviews with the five students observed in the class recordings. Each
of these students received candy for participating in each of the interviews. The first set of interviews established a baseline of the students’ self-reported self-efficacy beliefs and engagement indicators. At this point, the researcher began analysis of these qualitative data to build more questions for the next set of interviews as well as the potential axial codes and patterns to observe during the first observations.

**Student pre-implementation surveys.** After returning assent and consent forms, all students included in the study took surveys wherein they self-reported their self-efficacy beliefs and their engagement with mathematics. The researcher used Qualtrics to conduct the online survey and the students used iPads and personal electronic devices to access the survey. (For information about the creation of the survey, see the Selection Tool, Data Sources section above.)

**Phase II: Implementation.** The researcher gathered the majority of the qualitative data during the implementation phase of the study. The qualitative data from this phase came from two sources: (a) two observations each of Units 4, 6, and 9, and (b) two sets of interviews after Units 4 and 6. The following section explains the process of the observations and interviews.

**Recorded observations.** Phase II included the six recorded observations. The first set of observations occurred during Unit 4: Linear Inequalities. The first observation in this unit occurred as the students worked through a task graphing inequalities. The second observation included a test review of Unit 4. The researcher acquired materials used in each of the lessons observed from the participating teacher.

The next set of observations included lessons from Unit 6: Features of Functions.
The first lesson included a task where students defined a function and noted the features of functions. Two of the selected five students were absent during the first observation and one of the five was absent during the second of the observations of Unit 6. The second lesson of Unit 6 taught the students how to input values in equations using function notation.

The last observations occurred during Unit 9: Function Operations. During the first observation of the set, students worked in stations to learn how to add and subtract functions using tables, graphs, and equations. The second lesson taught students how to add and subtract functions as well as recognize the patterns and results of multiplication of functions.

**Students Phase II interviews.** Interviews occurred after the observations for Units 4 and 6. During the interviews after Unit 4, the researcher used the video recordings to show each student an example of his or her positive behaviors and an example of his or her negative behavior from the first set of recordings. The researcher asked the student to describe the behavior and then explain thoughts or feelings associated with their behaviors.

**Phase III: Post-implementation.** In Phase III, the researcher conducted the post-implementation interview with the teacher, the students’ post-implementation interviews that followed the observation of unit 9, and the class post-implementation survey.

**Teacher post-implementation interview.** The researcher conducted a post semi-structured classroom teacher interview. This interview allowed Ms. Green to provide additional insight into observations and behaviors of the students in class throughout the
four months of the study.

**Student post-implementation interviews.** This researcher conducted the fourth set of semi-structured interviews with the five selected students after the last set of observations of Unit 9. This fourth set of interviews provided student self-reported self-efficacy beliefs and engagement insights since enrolling in the ESC. The researcher developed the questions for the semi-structured interviews based on the axial codes and patterns that emerged from prior observations and interviews.

**Students Post-Implementation Surveys.** Of the 22 students in the class who participated in the pre-implementation survey, 19 took the same survey in the post-implementation phase. This provided quantitative data to analyze any change in students’ self-reported self-efficacy beliefs and engagement indicators. The participating students took the post-implementation survey in class on Qualtrics on an iPad or personal electronic device. Students who were absent on the first day of the post-implementation survey data gathering took the survey the next class day that they returned. The researcher then gathered the data for the survey from the Qualtrics software online.

Table 3 shows how the four data sources align with the phases of the study and provides the timeframe when the researcher collected the data for the different data sources and how those three sources align with the phases of the study.

### Data Analysis

Data came from (a) pre and post interviews with the classroom teacher, (b) pre and post student interviews, (c) student pre and post surveys, and (d) six class observations. The qualitative portion of this mixed-methods study allowed the researcher
Table 3

Phase, Instrument Alignment, and Timeframe

<table>
<thead>
<tr>
<th>Phase</th>
<th>Teacher data</th>
<th>Class data</th>
<th>5 selected students’ data</th>
<th>Timeframe</th>
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<td>Pre-implementation</td>
<td>Pre-Interview</td>
<td>Pre-Survey</td>
<td>Pre-Interviews</td>
<td>First 2 weeks of term 2</td>
</tr>
<tr>
<td>Implementation</td>
<td></td>
<td></td>
<td></td>
<td>1 week each set spread over 3 months</td>
</tr>
<tr>
<td>Post implementation</td>
<td>Post-interview</td>
<td>Post-survey</td>
<td>Set 4 of student interviews</td>
<td>1 week</td>
</tr>
</tbody>
</table>

...to interpret the meaning, and complexity of the teacher and student statements during their interviews and students’ actions in situ during the class observations (Creswell, 2013, p. 32). Quantitative data came from the pre and post-implementation student surveys and provided closed-ended information or information less open to subjective interpretation (Creswell, 2013). Mixing the qualitative and quantitative data provided a stronger understanding of how and why self-efficacy beliefs and observable engagement indicators changed over the course of the study. In other words, in this QUAL + quan convergent parallel mixed methods case study, the researcher made conclusions based on the patterns and axial codes that emerged from the qualitative data from the student observations and student and teacher interviews that the quantitative data did not provide. The quantitative data, however, provided evidence from the student surveys while the qualitative data provided evidence of observation and interviews that triangulated or converged to provide a more complete analysis of the conclusions (Yin, 2013). The
sections below describe the analysis process organized by data type in the Qualitative, Quantitative, and Mixed Data Analysis sections. The phases, data collection tools, and data analysis for this study are outlined in Table 4.

Table 4

*Phases of Research Design and Analysis*

<table>
<thead>
<tr>
<th>Research questions</th>
<th>Data sources</th>
<th>Data analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overarching question: How does addressing the needs of middle school students SBGL in mathematics by aligning teacher quality, peer support, and appropriate curriculum affect the students’ self-efficacy beliefs and engagement in mathematics classes?</td>
<td>Phase II: 3 sets of 2 observations of units 4, 6, and 9 using coding software and the Observation Protocol</td>
<td>Qualitative: coding of observations</td>
</tr>
<tr>
<td>How do students SBGL in mathematics exhibit observable engagement indicators, if any, when teacher, curriculum, and peer focus align with their academic needs?</td>
<td>Phases I, II, &amp; III: Student interviews</td>
<td>Qualitative: coding of observations and interviews</td>
</tr>
<tr>
<td>Phases I &amp; III: Teacher interviews</td>
<td></td>
<td>Qualitative: coding of observations and interviews</td>
</tr>
<tr>
<td>What self-efficacy indicators, if any, emerge in mathematics classes when teacher, curriculum, and peer focus align with the academic needs of students SBGL?</td>
<td>Phase II: 3 sets of 2 observations of units 4, 6, and 9 using coding software and the Observation Protocol</td>
<td>Qualitative: coding of observations</td>
</tr>
<tr>
<td>Phases I, II, &amp; III: Student interviews</td>
<td></td>
<td>Qualitative: coding of observations and interviews</td>
</tr>
<tr>
<td>Phases I &amp; III: Teacher interviews</td>
<td></td>
<td>Qualitative: coding of observations and interviews</td>
</tr>
<tr>
<td>How do self-efficacy and observable engagement indicators change when addressing teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect that focus on the academic needs of students SBGL?</td>
<td>Phases I &amp; III: Student survey</td>
<td>Quantitative: Descriptive statistics of pre and post tests and ANOVA comparison</td>
</tr>
<tr>
<td>Phase II: 3 sets of 2 observations of units 4, 6, and 9 using coding software and the Observation Protocol</td>
<td>Phases I, II, &amp; III: Student interviews</td>
<td>Qualitative: coding of observations and interviews</td>
</tr>
<tr>
<td>Phases I &amp; III: Teacher interviews</td>
<td></td>
<td>Qualitative: coding of observations and interviews</td>
</tr>
</tbody>
</table>
Qualitative Data Analysis

All three phases of the study included gathering qualitative data to help the researcher analyze students’ self-efficacy and engagement indicators. Because qualitative research with multiple participants can be overwhelmingly cumbersome, Ritchie and Lewis (2003) recommend limiting the size of study targets in qualitative research. Therefore, while observing the class as a whole and using the quantitative results from the whole-class surveys, this researcher concentrated her analyses of observations and interviews on the five selected students.

Interviews. The researcher used open coding on the interview data to identify general axial codes and patterns emerging from the data. The researcher transcribed the semi-structured interview responses from the classroom teacher and the five students. The researcher open coded the interviews by first highlighting repeated words or phrases in the transcriptions. After listing these words and phrases in Excel®, the researcher grouped them by theme. She then looked for patterns and axial codes of the overall project and addressing the overarching research question as well as the three more specific research questions. These open codes helped stimulate “generative and comparative questions” that guided the further investigation in the study (Corbin & Strauss, 1990). Recognizing the initial open codes, the researcher returned for axial coding that extended the “initial coding” and “describe[d the] category’s properties (i.e. characteristics or attributes) and dimensions (the location of a property along a continuum or range) and explore[d] how the categories and subcategories related to each other” (Saldana, 2015).

Teacher interviews. These interviews provided the researcher with insight into
how the teacher regarded these students and their ability. The pre- and post-
implementation interviews revealed codes that helped form the theoretical codes used by
the researcher and the second coder when watching the videos of the observations. They
also led to the axial codes used for analysis.

In the post-implementation interview, the teacher comments allowed the
researcher to investigate in greater depth the axial codes that emerged throughout the
study particularly in relation to the five selected students, their interviews, and the
researcher’s observations of changes regarding self-efficacy and engagement indicators.
The researcher again transcribed and coded these responses as in the pre-implementation
interview. These codes helped form the final analysis of the changes in students’ self-
efficacy and engagement indicators through the triangulation of the data in the mixed
methods sections.

**Student interviews.** The researcher transcribed each of the semi-structured
interview responses from the five selected students. The researcher open coded the first
interview looking for patterns and axial codes of the overall project and addressing the
overarching research question. The student pre-implementation interviews served as a
baseline for students to express their self-reported perceptions. These perceptions
included their mathematics self-efficacy and engagement in prior mathematics classes
and how they anticipated this class would differ. The axial codes revealed by the open
codes helped direct the focus of the research when establishing codes for the video
observations.

The emergent aspects of the design of this study allowed the researcher to look for
observable axial codes of the indicators throughout the review of the qualitative data (Creswell, 2013; Shank, 2005). These interviews also helped to establish additional codes that included actions (physical and verbal) that revealed behavioral and social engagement indicators associated with four different types of student interactions: (a) student-teacher, (b) student-peer, (c) student-tools, and (d) student-structure.

**Observation memos.** Memoing included descriptions of the room, participants, flow of the lesson, and teacher interactions. The researcher transcribed the memos noting when a class event clarified or expanded upon an indicator noted in the interviews or the videos. The researcher triangulated the codes that emerged from the memos with those in the spreadsheet from the interviews. The memos mainly helped identify student actions when student or teacher intent was not clear.

**Observation videos.** The researcher downloaded the classroom observation videos, edited them for time, and then focused on the five selected students. The researcher cut portions of the videos that showed students in prolonged repetitive actions. For example, if a student was quietly sitting at a desk complying with the teacher’s instructions, the researcher cut the middle portion of this event. Additionally, because a lunch break split this class period in two parts, the researcher cut students exiting for lunch, reentering after the break, and the taking of attendance. At times, recording equipment malfunctioned, students turned off the recording equipment, or students blocked the cameras from viewing the selected student. The researcher also cut these portions of the video.

After the first set of observations, the researcher then employed the Vosaic
Connect software (Vosaic, 2018). Using the observed behaviors and codes that had developed from the observation protocol for the first observation set, the researcher developed the additional codes to enter into the Vosaic software. While this software allows the researcher to observe and code student actions live, the researcher opted to write memos during the observations and use the software to code the videos after the observation sets were complete. The memos served to remind and inform the coders of what happened if and/or when audio equipment failed or was tampered with during the observations.

Coders tagged students’ actions and expressions online using Vosaic Connect. This software also allowed for notes and annotations about student engagement. Additionally, coders could label these actions and expressions as positive or negative depending on whether students’ actions contributed positively towards learning the mathematics of the lesson or detracted from the intent of the lesson. Additionally, tags describing the activity allowed the coders to coordinate which action would fall under which engagement behavior. Unanticipated engagement indicators or undetermined engagement behaviors were coded as unknown when student intent of their actions was not clear. The researcher used compound indicators or memos and interviews to clarify undetermined indicators exhibited during recordings.

Coding of the observations using Vosaic software allowed the coder to indicate the time and duration of the event on the recording tagging the engagement indicator with the teacher, with peers, with tools, or with class structure. At times, these overlapped. Additionally, Vosaic allowed for easy reference and analysis of emerging axial codes
after coding by providing CSV files to sort and arrange codes. Compound events that occurred simultaneously or sequentially in the data lists allowed the researcher to infer more accurately the intent of the engagement.

The researcher and the additional coder met five times to develop, discuss, and define the codes used to analyze the videos. After the coders had initially developed the codes in their first meeting, the videos of the selected students were then uploaded into Vosaic Connect, an online coding software. The researcher and the interrater reviewer then each coded a 32-minute section of one of the selected students. After the coding, the researcher downloaded and organized the data in Microsoft Excel. She cleaned the data of extraneous data of Moment Name, Number of Tags Added, and Global Moment Sequence as these columns did not add to the evaluation of the codes. She then compared the code time stamps, code duration, and code type to establish interrater reliability. The researcher and second coder then met the second time to discuss differences in their coding results.

Some of the codes differed as a result of user-error with the unfamiliar software. Reviewing the video, the coders agreed on and changed those codes that were discrepant. Some differences occurred because some of the codes listed were vague. For example, if the teacher had instructed the student to use a ruler to graph a line on a paper, one coder noted this as student-teacher physical engagement as the student was physically complying with the instructions of the teacher. The other coder had noted this as student-tools physical as the student was properly using the tools provided for the assignment. After discussing how these common events occurred, the coders agreed on how to
address these events and adjusted their coding in those data. The coders only noted two additional events that they could not fit to one of the preset coding categories and added those to the codes’ list. The final list of codes uploaded to the Vosaic program appear in Table 5.

The coders met a third and fourth time to compare and adjust codes to use for observation. After the initial independent coding sessions, the researcher downloaded the data from Vosaic into Microsoft Excel, cleaned the data, and found an 89% agreement in coding practice. The researcher then uploaded a second 41-minute video of a different student. The downloaded codes showed an initial agreement at 82%. A third 62-minute video showed an 84% agreement for an overall interrater reliability average of 85%. Because reliability appeared to be consistent, the coders agreed they would post comments addressing questions about student intent in the video software. When analyzing the data for the study, coders downloaded and consulted the notes for clarification. This allowed the researcher to interpret the second coder’s intent when coding obscure video sections.

After the coders completed their coding of each of the videos, the researcher ordered the codes by category (i.e. student-teacher, student-peer, etc.), by type (i.e., watching teacher, misusing tools, etc.), and by time stamp. Comparing the sets of codes from the observation sets, the researcher identified patterns in the codes that denoted observable changes in the students’ degree or type of observable self-efficacy beliefs and engagement indicators over the course of the study.
Table 5

*Open Codes for Engagement Indicators for Video Observations*

<table>
<thead>
<tr>
<th>Engagement indicator type</th>
<th>General behavior tag</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student-teacher physical</td>
<td>Positive</td>
<td>Watching the teacher</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Following Instructions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Waving happily</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Give hug/high 5, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smiling</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>Ignoring instructions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Head on desk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inappropriate gesture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Throwing item at teacher</td>
</tr>
<tr>
<td>Student-teacher verbal</td>
<td>Positive</td>
<td>Ask/Answer questions appropriately</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pleasant conversation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supportive comment</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>Inappropriate comment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Talking back</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vulgarity toward teacher</td>
</tr>
<tr>
<td>Student peer physical</td>
<td>Positive</td>
<td>Hug/High 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smiling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clapping in support</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>Inappropriate gesture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Turning away (rejection)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Distraction during the lesson</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clapping at error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hitting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Watching listening to peer instead of teacher</td>
</tr>
<tr>
<td>Student-peer verbal</td>
<td>Positive</td>
<td>Verbal encouragement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Helping with a problem</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pleasant conversation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Welcome</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compliment</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>Insult</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verbal distraction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Name calling</td>
</tr>
</tbody>
</table>

*(table continues)*
<table>
<thead>
<tr>
<th>Engagement indicator type</th>
<th>General behavior tag</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student-tools physical</td>
<td>Positive</td>
<td>Using tools appropriately</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Getting tools to use</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>Misusing tools</td>
</tr>
<tr>
<td>Student-tools verbal</td>
<td>Positive</td>
<td>Acknowledging tool’s value</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Request use of tool</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>Complaining about tool</td>
</tr>
<tr>
<td>Student-structure physical</td>
<td>Positive</td>
<td>Homework complete</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sitting in assigned seat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Obtaining hall pass to leave</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Volunteer/Raise hand to participate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Approaches board to work a problem</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arrives on time</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>Tardy/late</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dress codes violations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Switching to unassigned seat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wandering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disrupting procedures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Homework incomplete</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eating/drinking in class</td>
</tr>
<tr>
<td>Student-structure verbal</td>
<td>Positive</td>
<td>Verbal acknowledgement of procedure value</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>Complaining about a rule</td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Quantitative Data Analysis**

To answer research questions 1, 2, and 3, the researcher explored the descriptive statistics of mean and standard deviation of the results of each survey question by item and by type. The researcher gathered these data in Qualtrics and then exported, organized, and cleaned them in a Microsoft Excel spreadsheet. The researcher then evaluated the questions in groups associated with the five indicators: self-efficacy, engagement-behavioral, engagement-cognitive, engagement-emotional, and engagement-social in *International Business Machines* (IBM) analytics software entitled *Statistical*
Package for the Social Sciences (SPSS). The researcher also adjusted the data for reversed questions by subtracting the responses from 5 to reverse the numeric input for those questions.

The researcher created groups for the self-efficacy and engagement indicator pre- and post-implementation survey results. The researcher then used SPSS to calculate an average score for each of those indicator types. The researcher ran Repeated Measures ANOVA’s, mixed design ANOVA’s, paired samples t tests, and independent samples t tests on the pre and post data.

**Self-efficacy beliefs.** The researcher used independent paired sample t-tests to compare the change in participants’ self-efficacy beliefs from the pre-implementation survey results to the post-implementation survey results of the thirteen self-efficacy items. The researcher used SPSS to determine the pre- and post-implementation means and standard deviation scores as well as the change in the scores.

**Engagement indicators.** The researcher used a paired sample t-test to compare the change from the pre-implementation survey results to the post-implementation survey results of the 33 engagement behavior items. The researcher used SPSS to determine the pre- and post-implementation mean and standard deviation scores as well as the change scores. A paired-sample t-test illustrated the comparative change between students’ self-reported engagement indicators before participating in this class and the self-reported engagement indicators after participating in this class. The researcher explored these data for the indicators by item and by category of engagement (behavioral, cognitive, emotional, and social).
The results from the paired-sample $t$ tests were plotted in a dot graph for visual analysis to represent the data produced from the pre- and post-implementation surveys. This representation allowed the researcher to analyze the data in their entirety (Dickenson, 2010).

An ANOVA showed the comparison of how the various engagement indicators changed as the dependent variable to the different engagement indicators as independent variables and how the engagement indicators as the dependent variable compared to the different self-efficacy items as independent variables. The researcher recorded the results for the mean in the class and for the remaining five observed students.

**Mixed Methods Analysis**

After independently completing the qualitative and quantitative analyses, the researcher merged the results and derive “meta-inferences” that provided “an understanding of the phenomenon under investigation” (Teddlie & Tashakkori, 2009, p. 266). Teddlie and Tashakkori (2010) later described a meta-inference as “an overall conclusion, explanation, or understanding developed through an integration of the inferences obtained from the qualitative and quantitative strands of mixed methods study” (p. 101).

Mixing the qualitative results with the quantitative data provided triangulation with self-reported data of students’ increase in students’ collective change in self-efficacy and engagement in mathematics when addressing teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect that focus on the academic needs of students SBGL.
CHAPTER IV
RESULTS

The purpose of this study was to examine how aligning teacher quality, peer support, and appropriate curriculum affected the self-efficacy beliefs and observable engagement indicators of ninth-grade students who perform SBGL in mathematics. In this chapter, I will first report the results from the analysis of the qualitative data gathered in the study. Second, I will report the results from the analysis of the quantitative data from the study. Third, I will report the meta-inferences from the data as they converged and diverged in this QUAL + quan convergent parallel mixed methods case study.

Qualitative Data Results

The qualitative data in this study came from four sets of student interviews, the teacher interviews, and the classroom observations. I recorded and transcribed the interviews and then open coded the interviews looking for common themes and patterns in the responses from the students. I recorded the classroom observations and then, with a second coder for validation, used Vosaic software to open code those observations. Through open coding, I recognized axial codes or themes that emerged in each of the effect constructs (teacher, teacher-curriculum, peer-curriculum, and peer). In this section, I will introduce and describe the axial codes that emerged relating to each effect. Additionally, I will discuss how the data indicated self-efficacy and engagement relating to those axial codes and effects. Figure 3 illustrates how the axial codes and open codes relate to the four effects as revealed in the study.
Figure 3. Themes (axial codes) related to effects. The themes emerged from the open codes as listed below each of the axial codes.

The upper left quadrant of Figure 3 shows teacher effect and the axial codes positive student-teacher relationships and behavioral expectations. The open codes that revealed the axial code positive student-teacher relationships include the students’ perceived relationship with the teacher and the students’ perceived success. The open codes that revealed behavioral expectations were appropriate participation and students’ help-seeking practices. In the second quadrant, the axial codes that emerged relating to teacher-curriculum effect include pace and content and the challenges of absenteeism. The open codes that revealed pace and content included academic expectation, optimism
of future success, and confidence. The teacher and students expressed frustrations resulting from frequent or prolonged absences revealing the challenges of absenteeism. The third quadrant contains the axial codes relating to peer-curriculum effect including peer perceptions and peer responsibility. The open codes leading to peer perceptions include students’ comparative ability, class comparison (or how students’ peers perceived and reacted to how the ESC differed from regular-level classes), and placement (or the concerns related to placement in the ESC). The open codes revealing peer responsibility include positive and negative engagements, peer support, and the emergence of leadership roles in the ESC. In the last quadrant, peer effect related to the axial code peer influence. Open codes indicating peer influence included desire for acceptance, influences on behavior, and motivation. In the following sections, I will expound upon each of these codes and reveal how I found the open codes relating to the effects as well as to self-efficacy and engagement.

Teacher Effect

Figure 3 shows two axial codes related to teacher effect: (a) positive student-teacher relationship, and (b) behavioral expectations. These axial codes explained how students’ statements and actions related to teacher effect.

Positive student-teacher relationship. The axial code positive student-teacher relationship included two open codes: (a) perceived relationship and (b) perceived success. These open codes reflected students’ perceptions about their participation in the class and how they related to the teacher and their own performance.

Students’ perceived positive relationship with the teacher. The open code
perceived relationship included student phrases like “she’s nice,” “she’s fun,” and “she’s chill.” Hayden explained a difference in this class is that he “can relate with the teacher.” This perceived relationship was contrasted with students’ descriptions of their relationships with other teachers describing these teachers as “more strict.” Ms. Green provided a more relaxed environment that the students described as “chill.” This structure gave students more freedom to get up and move around the room. She often demonstrated this desire to foster a relationship using familiarity and proximity.

For example, the lesson for the first observation involved students learning to graph systems of inequalities. The teacher separated the students into groups, which worked on two different scenarios involving graphing systems on a map. Ms. Green facilitated a lesson with eight students at one station and the paraprofessional worked with the other eight students in attendance at another station on a different part of the task. These teachers led the student discussions and answered students’ questions. After 15 minutes, the students switched stations to complete the other half of the task.

Lincoln asked and answered questions appropriately while working with Ms. Green and finished the first half of the task as she sat with the group and conducted the task with casual conversation. While working with the paraprofessional, Lincoln ignored instructions, talked during the task, and laughed and joked with his peers while he should have been working on the assignment. In the interview following the observation, I asked him why he tended to behave appropriately for Ms. Green but did not when working with the paraprofessional. He responded, “I was just saying to my friends that [Ms. Green] was sitting with us. She wanted us to do it. [The paraprofessional] is, like, over us,
walking around most of the time. [Ms. Green] is just chill.” From this discussion, Lincoln perceived the act of the teacher’s proximity while sitting with the students indicated her interest in the students. Lincoln’s behavior reflected a perceived positive relationship. I found this corresponded with a more positive performance in the class. Lincoln’s reaction to the paraprofessional’s body position of standing over the students differed from Ms. Green’s sitting next to the students and working with the students.

Lacey’s response to her relationship with classroom authority differed from the other four observed students. I observed Lacey working diligently on assignments and when she encountered difficulty, she quickly turned to Ms. Green or the paraprofessional for help. At times, she would have long conversations asking them for affirmation about her work or her ability. During the first interviews, she thoughtfully responded to my questions, but when I would restate her answer or ask for clarification, Lacey would change her position or rephrase her answer to gauge whether it was more acceptable. She would then ask if her new answer was correct. Lacey’s responses to the teacher, the paraprofessional, and to me as the researcher indicated her desire to establish a relationship founded on approval.

*Students’ perceptions that Ms. Green wanted them to succeed.* Open codes indicated that students perceived Ms. Green’s desire for their success. This differed from the previous open codes in that their perceived relationship was not just that the teacher and students liked each other. The students perceived that the teacher, in addition to being “nice” and “chill,” wanted the students to master certain concepts and goals in their mathematics class. For example, Marco described his interactions with his other teacher
saying “she wouldn’t let us ask questions while she was, like, working.” He contrasted this with Ms. Green who let him “ask more questions.” These codes included observations of students working in spite of challenges they met regarding their mathematics work. This perseverance also aligned with students’ perceptions of a positive relationship with the teacher.

Ms. Green tried to foster a belief in the students that they could succeed. She stated. “If they want to be successful, this class is definitely that...I do think that my relationship has a lot to do with it, but I don’t think that’s the whole thing. I do know that the class is ran (sic) so that it is engaging. I always tell the students that the work and the homework is doable for them.” She tried to convey to the students her belief that they could succeed although their past performance had convinced them that they “never knew how to do [math].”

Ms. Green allowed the students many opportunities to ask questions, talk, engage, and participate in the mathematics tasks and lessons. This demonstration of patience conveyed her desire for the students to understand the content. She stated that students ask, “Why has no one ever taught me that before?” Because the ninth-grade teachers all teach the same standards from the same curriculum, their prior ninth-grade teachers should have taught those concepts before. These students, however, did not recognized that these concepts may have been taught, but they did not experience relational understanding to make the connection with the new content. This query also indicates they perceived that Ms. Green taught them in a way they could succeed. Hayden attributed this perception to how Ms. Green “teaches so everyone can learn.”
Marco summed up his perception of the importance of the positive student-teacher relationship and teacher effect saying, “[It’s important to] have a nice relationship, you know. ‘Cause if you have a bad relationship with her (the teacher), you guys won’t like really help each other.” This relationship began with a “nice” and “chill” teacher, but Ms. Green’s purpose extended this relationship of personalities to a relationship of purpose—succeed in mathematics. The ninth-grade teachers placed students in the ESC because they were not successful in a regular-level class even after the additional support of a daily mathematics class. Even though teachers may not have told students the reason for the placement, the students explained that they knew that they were in this ESC because of their low ability. Most of the students explained in interviews that they were in the class “to get a little help.” Ms. Green explained that the students “realize that it’s an opportunity and when they are in the class, most of them excel...They are able to be successful.”

Ms. Green conveyed her desire for student success and her reward as a result. When asked how she felt about teaching this group of challenging students, she replied,

I love it. It’s my favorite.... Being able to watch kids succeed that have never been successful is so rewarding. Most of the kids have never enjoyed math and never liked math, never been successful in math and it’s fun to watch them have that success.”

I observed Ms. Green laughing and joking with the students as well as patiently explaining and re-explaining concepts to students in class and individually. This patience and casual demeanor defined an atmosphere wherein the students exhibited an increase in positive behaviors that could affect learning. Students said they could “ask more questions” and “understand the math” without the pressures of time and control.
**Behavioral expectations.** Another axial code relating to teacher effect was *behavioral expectations*. This axial code emerged from the open codes *appropriate participation* and *students’ help-seeking practices*.

**Appropriate participation.** Ms. Green noted that one challenge of teaching the ESC was misbehavior. Teacher quality and experience provided a background to establish the expected norms established for the students when in class. She noted,

> One of the biggest frustrations is behavior. Students have always, well not always, but have been able to misbehave in class and when you stick them, a lot of kids, in the high demand in a class like this (sic), there’s a lot of behavior that we just really try to keep close eyes on.

As the study progressed, the students seemed to recognize their responsibility in their classroom behavior. In the first interview, I asked the students who they believed should enroll in the ESC. They each responded in some form as, “Any student who struggles in mathematics.” In the final interview, I asked the students which students should be allowed in the ESC. They still stated that students who struggled should take the class, but they also indicated that teachers should not enroll students who would not conform to classroom norms. The students described those who should not be allowed to take the class as follows:

**Lincoln:** [Those who] don’t do work. Don’t pay attention. Talk while the teacher’s talking and a lot of other obnoxious things.

**Marco:** The kids that don’t belong are the kids that don’t do homework and don’t pay attention. Just goof around and it shows basically has a F in that class the whole term. Those kids, like, it shows us and the teacher that they don’t really care. Someone who cares deserves to be in there...Basically [the student that doesn’t belong] just goes and then doesn’t even do the starter. Doesn’t even do the notes. Just talks and talks. Interrupts and doesn’t even do homework. Just goes in there just to play. And then like it’s not just one day. It’s like every day.

While their comments generally described misbehavior and distractions in the
classroom, they also acknowledged an expectation of academic participation. I observed Ms. Green facilitating the lessons in six separate observations. Each time, she had students demonstrate the mathematics of the lesson at the board. Students showed that they understood her expectations by consistently volunteering to do the work. Hayden stated that he believed Ms. Green made an effort to “involve everyone” in the lessons by calling on them and having them show their work. Ms. Green stated, “[The students are] able to come up. They’re the ones now doing problems at the board.”

As time passed in the study, I observed students’ actions change as they developed a relationship with Ms. Green and their behaviors conformed more to class norms. They began to stay in their seats during lectures, their verbal interactions with the teacher and paraprofessional were more respectful, addressing the teacher by title and name (“Mrs. Green” rather than just calling out requests or answers), asking permission to change seats, or raising their hands to comment or answer. Students also created fewer classroom disruptions to try to derail the lesson.

I observed that Ms. Green developed positive student-teacher relationships in her use of proximity, support at the board, and patient repetition of answers to students’ questions. This contrasted the paraprofessional who focused her interactions with the students on monitoring behaviors, keeping the students on task, and providing instruction when needed. The students stated that they preferred to work with Ms. Green because she was “nice” or “chill” while they described the paraprofessional as “more strict.” While the paraprofessional focused her role to maintain classroom management, Ms. Green’s pedagogy implemented a more approachable demeanor with the students.
Ms. Green explained that she structured the class in a less rigid fashion than in her regular-level classes regarding rules and also tried to keep the students physically and mentally active. She stated,

Because of the nature of [the class], we are keeping...engagement... We’re giving hands-on activities, being able to, um, learn kinesthetically, so we’re moving, doing stations. [The students are] involved. They’re not sitting and taking notes, so they’re usually able to focus much more and be able to understand the concepts.

As this relationship grew over the course of the study, I observed students interacting more causally but respectfully with the teacher in their conversations not only about mathematics, but also about friends, home, and other classes.

**Students’ help-seeking practices.** I anticipated that these ninth-grade adolescent students SBGL in mathematics would have overtly negative attitudes towards mathematics. Instead, I found, through the interviews and observations, the students seeking help to overcome what they knew was a deficit in their mathematics understanding. This was evident even at the beginning of the study. They perceived that this different class structure afforded them the opportunity to work with a teacher who would help them develop the skills they lacked.

The five students SBGL in mathematics all stated in their first interviews, “I just need a little help,” “I get more help [in this class],” and the class and teacher were “helping me a lot.” They also stated that they believed Ms. Green and the paraprofessional would help them.

For instance, Marco stated that he would do well in the ESC and then expressed his belief that the teacher of his regular-level class would not readily help him.
The other class was hard and I didn’t understand it and I didn’t know what to write. The teacher was kind of like really strict about talking and stuff so I didn’t like to talk. I’d just leave it blank.

I asked the students if they participated more in this class than in their other mathematics classes. They all stated that they did participate more. When I asked Lincoln why he participated more, he replied, “[The previous teacher] wouldn’t help us as much. She wouldn’t let us ask questions while she was, like, working so I just never went up (to the board) because I never knew how to do it.”

The students perceived that having access to two teachers in the class also gave them the extra help they needed. Marco mentioned, “If a student need (sic) help and I need help then there is another teacher so I can learn it faster and I won’t forget. By the time she gets to me, I won’t forget the question.” Likewise, Lincoln noted the importance of extra help in the class. “Now I have a lot more help than with the other teacher. Now, there’s two and so one teaches while the other helps.”

The students contrasted their perceived relationship with Ms. Green with that with their other mathematics teachers. Mason explained, “[Ms. Green] was helpful because she went around and helped us and showed us how to do it and it just really had an effect.” He described his prior class as “the kind where all the smart people go.” He then gave his impression of his prior teacher; “I’m not saying she’s a bad (sic), she just goes fast.” He added, “Without [Ms. Green’s] help, I don’t think I could do it (learn mathematics).”

In the first observation, I observed that when Ms. Green asked for volunteers to work a problem at the board, eight of the 23 students in the class excitedly raised their
Five of these eight students had been in the class since the beginning of the year.

She called on different students to solve each of the four problems so different students
could showcase their knowledge. The students whom she did not choose groaned in
disappointment.

At this time, Lincoln also eagerly volunteered. When he got to the board,
however, he said that he no longer wanted to work the problem. She asked him why and
he shrugged. She stated, “It’s not that hard. Let me help you.” At that point, he continued
and solved the problem. When asked later why he had changed his mind, he explained, “I
didn’t recognize how to do it.” I asked him what difference it made when Ms. Green
approached him. He said, “I kind of remembered how to do it and I knew how to do some
of it. She just helped me.” I memoed that he solved the problem correctly with very little
prompting from Ms. Green. Ms. Green’s proximity may have emboldened Lincoln’s
persevere in solving the problem as he perceived her support.

**Self-efficacy and engagement in teacher effect.** As students developed a
relationship with the teacher, they developed their own sense of autonomy and self-
efficacy in their work. At the beginning of the study, when asked what they would do if
the teacher asked them to work a problem at the board that they did not know how to
solve, the students replied, “I would ask for help.” At the end of the study, the students
responded to this same question saying, “I would try different ways to solve it.” Teacher
effect provided them an avenue to develop the tools to solve problem in different ways.
Teacher effect also provided a framework upon which students developed multiple tools
to use while maintaining an autonomy in implementing those tools to solve problems.
The teacher explained how, over time, “Students develop the ability to explain their thinking when they work at the board.” Her aim as teacher/facilitator was to provide the students with the help they needed to develop a self-efficacy and belief in their own ability. This perceived teacher support may help students improve performance and self-efficacy (Sakiz, Pape, & Hoy, 2012). This change in how students approached mathematics challenges indicated that the students perceived they learned to use the tools they needed without depending on the teacher’s help. Ms. Green said, “We try to give them tools to be able to fill some of those gaps of using a calculator, relying on some of the different tools that are available for those students.”

Initially, students turned to the teacher for support. As the students practiced using a variety of tools, they began to engage with the mathematics by making new connections among mathematics concepts. In the final interview, Hayden and Marco both stated that learning mathematics is “easy” and “fun.” They still acknowledged that they had to “work to learn the math,” but they expressed their increased self-efficacy when they stated they “could understand it.” Lacey noted that the key to learning mathematics was, “Practicing all the time and knowing, like, to have someone to help you.”

Each student interview began with the casual question, “How’s class going now?” In the first and second interview, students commonly responded with a shrug or “OK.” By the third interview, two of the students stated that class was “awesome.” This statement indicated the student’s positive emotional response to the class and the student’s perception of his or her performance in the class. While the students did not express great excitement about mathematics, by the final interview, they all stated that
they “liked” or “really liked” the class.

Hayden explained in his final interview that he liked the class more because, “It’s a bit more student-focused not like subject focused. [The teachers] pay attention to the students more and how they’re doing in math and how they’re going to accomplish stuff.” This comment illustrates how the positive student-teacher relationship (teacher effect) aligned with his perception of the class and student emotional engagement.

Data show that students believed Ms. Green’s actions illustrating her desire for their success. The students believed Ms. Green thought they could learn mathematics. This belief aligned with the positive change in their behaviors and Ms. Green’s expectation of compliance with class norms. I also found that students entered the class recognizing their need and want for help. As they worked for and received this help, they made more self-efficacy statements of “I can” and “I understand” and engaged emotionally more appropriately with mathematics tasks and activities.

In summary, the axial codes positive student-teacher relationship and behavioral expectations related to teacher effect in that the qualitative data reflected the elements of teacher effect as operationalized by teacher quality, teacher-student relationships, and expectations of student behavior. Within this structure of the ESC, the students noted the teacher’s apparent interest in helping the students succeed and their actions within the classroom reflected the teacher expected norms for the class.

Teacher-Curriculum Effect

Figure 3 shows the two axial codes that related to teacher-curriculum effect: (a) pace and content and (b) the challenges of absenteeism. Teacher-curriculum effect relates
to how the teacher and curriculum affect the students’ self-efficacy beliefs and engagement. The ninth-grade teachers determined the essential standards from the state mandated mathematics core that these students SBGL in mathematics would need to master in order to be successful in ninth grade and to prepare them for tenth grade. Ms. Green explained, “[The students are] still learning the core and mastering the content that [we determined] are needed and required for ninth grade.” She explained that she focused her instruction only on the essential standards rather than all of the ninth-grade standards in the core. (A comparison of the essential standards for the ESC to the standards covered in the regular-level class for the observed lessons are included in Appendix B.) She explained, “There is gonna have to be (sic) some stuff that I can’t always cover, but when you look at the essentials that they need to build to be successful for next year, those are our main focuses.”

**Pace and content.** The axial code *pace and content* related to teacher-curriculum effect when students believed they could understand the mathematics concepts when fewer of them were presented at a slower pace as covered in the ESC. The open codes that revealed *pace and content* included (a) *academic expectations*, (b) *optimism of future success*, and (c) *confidence*.

**Academic expectations.** The open code *academic expectations* related to the axial code *pace and content*. I found that students recognized their low ability but understood Ms. Green’s expectations that they work to improve that ability. This code related closely to behavioral expectations under teacher effect, but deals with the academic expectations of student participation rather than the prosocial behavioral expectations. In the pre-
implementation phase of the study, students commonly described their mathematics ability as “not good” or “bad.” Two months into the study, all of the students stated that their mathematics ability was “as good as” or “better than” their peers.

When I asked Lincoln how he was doing in mathematics in this class, he explained that he was still failing term one but he had “improved a lot” and anticipated better grades for the third and fourth terms. He explained the process of making up his missing credit by doing “extra mathematics packets” that reviewed prior content. He was willing to meet the academic expectations to improve his mathematics ability by doing the extra work with the support of the teacher and paraprofessional. He contrasted these extra efforts with his prior efforts in his regular-level class as follows:

**Researcher:** How do you think you would have made up these grades if you had stayed in the regular class?

**Lincoln:** I don’t know.

**Researcher:** Would you do it?

**Lincoln:** I probably wouldn’t do it.

Ms. Green had provided a structure that Lincoln perceived would help him make up his previous grade as well as continue his success. Teacher-curriculum effect involves how the teacher enacts the curriculum. From my analysis, I found that students perceived that Ms. Green had designed the content so they could succeed in the class.

In pre-implementation interviews, the students all stated that Ms. Green had the greatest impact on whether they would succeed in the class (teacher effect). Two months into the study, however, I asked students which of the four educational constructs of this study (teacher effect, teacher-curriculum effect, peer-curriculum effect, or peer effect)
they perceived had the greatest influence on their learning. Two of the students restated that teacher effect made the greatest impact on learning because students got “more help” and “she’s like always so nice helps us with our grades.” However, two of the students stated that the most important element of the ESC and their success was “covering fewer things” and that Ms. Green “goes slower.” Hayden stated that the most important element of the ESC was both.

I think that they both, sort of, like, halfway. Like the content and stuff goes halfway and it makes it good, yeah. The other half is the teacher. If it’s just the teacher but the content isn’t very good then it’s just OK.

Students began to see the help they needed was two-fold: a teacher who would help them when needed (teacher effect) and the structure of the class and the content that would help them fill their academic gaps (teacher-curriculum effect).

Another class structure in place at this school to help many students was a daily mathematics class. Because classes at this school met every other day, this class, labeled Daily Dose, met on the days when students did not attend their assigned mathematics class. Before teachers enrolled the students in the ESC, the students took the Daily Dose class to see if that would suffice to help them learn their mathematics. When I asked Lacey if the structure of the ESC and the tasks used helped her learn the material, she explained her thoughts in relation to her enrollment in the Daily Dose class.

Lacey: Well...the teacher was also helping us. Um, I feel like [the mathematics task] helped us a lot.

Researcher: Did you use to do these kinds of activities in your other class?

Lacey: Kind of in double dosing (Daily Dose), kind of. In my normal math class we didn’t. In my normal one because, that’s an actual math class like the one that (long pause) I don’t know how to explain it. The double dosing one and this one
is (sic) to help us more if we’re not understanding it.

**Researcher:** What’s the difference between a normal math class and this one?

**Lacey:** This one is extra help. The normal one is a regular thing you would do with more stuff.

When discussing activities and tasks, students often mentioned they had more opportunities to ask questions and get help from either the teacher or the teacher and the paraprofessional in the ESC.

Lincoln stated that being able to get help and learning fewer concepts helped him make sense of the mathematics. “It is a lot easier now that I know what to do and now that I’m paying attention. I don’t have to, like, process as much stuff. It’s crazy.” Thus, by allowing students opportunities to engage cognitively with well-designed and enacted mathematics tasks focusing on fewer concepts, students perceived that these tasks helped them learn mathematics.

Lincoln’s comment about the having to “process as much stuff” leads to another aspect of pace and content; these students’ SBGL in mathematics indicated that they felt overwhelmed by the speed and number of concepts in their regular-level classes in spite of other school interventions targeted to help them learn the mathematics (Daily Dose, tutoring, homework help classes).

Students commented in the first interviews that their prior teachers taught the concepts “too fast” and “there’s too much” to learn. They also explained that, in the ESC, they could “learn at their own pace.” Two months into the study, I asked the five students, “Now that you are in [your] third term, how do you feel about this class?” Two students stated that the class was “awesome,” one stated that it was, “pretty good,” and
two stated that it was “pretty easy.” All five stated they “can do it” although sometimes they admitted that they needed more review to understand. For instance, Marco stated, “Sometimes I don’t get a math problem and get disappointed ’cause I don’t get [a problem], If [Ms. Green] like goes back and goes slow and gives me more problems to work on, then I can do it.”

Hayden perceived the class helped develop his ability and tied his perceived progress to the pace the teacher used to teacher the mathematics. He said, “When I first started it was hard and stuff. This class has helped me to, like, reset and learn all this stuff.... We go through stuff a lot slower and other students can like get it.”

Students who experienced frustration in prior classes recognized the slower pace of the ESC. The teacher-curriculum effect of the adapted curriculum lessened this frustration as they concentrated on fewer concepts at a slower pace. Limiting the number of concepts allowed more time for students to master essential concepts.

Ms. Green did not expect the students in the ESC to master every concept outlined in the state mathematics core and mentioned her frustration of not being able to teach all the ninth-grade standards covered in a regular-level class. She explained, “There will probably be gaps and we know that we can’t fill all of their gaps.” She justified the cutting of extension concepts, however, to focus on filling the gaps in students’ understanding and establishing a stronger mathematics base.

Ms. Green: A lot of them, their skills are so low that as we talk about some of the basic things, we’re/I’m (sic) constantly having to review. It’s something we use calculators for. We pull out number lines. Their number sense is so low than an average student (sic) that they have a hard time being able to understand things because their skills are so low.
**Researcher:** So what have you observed in this class that tells you that’s true?

**Ms. Green:** So being able to multiply something by zero. We got out a calculator today to prove to a girl that yes, three times zero is zero. We were pulling out number lines, talking about negative numbers first. Inequalities, greater than, less than. They can’t just know that like most students can. We had to show them on a number line.

The question remained as to how Ms. Green could address the needs of students SBGL in mathematics and prepare them for tenth grade when they began the course years below grade level. I asked her about the daunting task of pacing the class to present the standards of the state core.

**Ms. Green:** The pace isn’t any slower. I’m on almost the exact pace of my regular classes. So the pace isn’t necessarily slower. I do work in one extra assignment that is kind of a pre-loader that kind of helps and builds the foundations that they need to be successful in that unit. Quality of instruction? They’re still getting challenged. They’re still working hard. They’re still learning the core and mastering the content that are needed and required for ninth grade.

**Researcher:** So how can you cover the same concepts in the same amount of time but meet their needs.

**Ms. Green:** I think there’s a lot of things, and yeah, there is gonna have to be some stuff that I can’t always cover, but when you look at the essentials that they need to build to be successful for next year, those are our main focuses.

**Researcher:** To be clear, you are dropping some concepts and not teaching them in this class.

**Ms. Green:** It would be more of the higher level if you really look at the essential part of the core and from the district. Those concepts are definitely being taught and being mastered. I demand just as much. They get homework every night. They are expected to stay on task. They are expected to take notes just like any other student. They are expected to have mastery. So, definitely not low expectations. Sometimes with the contract (that they sign to enroll in the class), I think that their expectations are actually higher.

Ms. Green’s explanation of pace referred to how she teaches the same overarching concepts aligning with the time in the year that those concepts are taught in
the regular-level classes. For example, Ms. Green taught graphing inequalities in the ESC at the same time it was taught in the regular-level classes. Ms. Green, however, did not include the concept of writing systems of inequalities from story problems, a concept required by the state and deemed by the ninth-grade mathematics teachers as important for students enrolled in a regular-level ninth-grade class. This afforded her additional time to cover the basics of graphing and identifying the solution set to a system.

**Researcher:** What disadvantages does this class present to these students in the future?

**Ms. Green:** That there will probably be gaps and we know that we can’t fill all of their gaps. But it is definitely something that we try to give them tools to be able to fill some of those gaps of using a calculator, relying on some of the different tools that are available for those students. But other than that, I don’t think there’s a huge disadvantage at all to this class.... I think any student is going to struggle and have to work hard and I don’t think that it’s any different with these kids although I think they have the confidence and the ability. They have hopefully filled the gaps and been given a good strong foundation to build on for next year.

Thus, Ms. Green perceived that she developed an important structure in her presentation of the state core by targeting instruction only on the ninth-grade concepts most essential to students’ foundational knowledge of present and future mathematics.

**Optimism of future success.** The open code *optimism of future success* was found to relate to the axial code *pace and content* and illustrated a change in students’ perceived ability over the four months of the study. Initially, the students SBGL in mathematics expressed frustration and defeat with phrases like, “it’s just too hard,” and “I just don’t get it.” Later in the study, student statements included, “I’m going to get an A third term,” “I’ll do better in fourth term,” and “I want to graduate from college.” These statements illustrate the students’ perceptions that they could do mathematics better than
their past performance and were setting higher academic goals.

In addition to stating that they would get “an A” in third and fourth term, Hayden, Mason, and Marco all stated that their goal was to “get good grades” in high school. They felt that they “understood the math” better now and they could improve the coming year.

Four of the five students also stated that they would go to college after high school. Marco explained, “My father dropped out of eighth grade” and “he has to work really hard and is tired.” He then explained, “My mother also dropped out of school in eighth grade” and “my older brother most likely will not finish high school. I’ll be the first.” He stated that he wants to become a “PE teacher.”

Ms. Green commented that many of these students SBGL in mathematics in the ninth-grade could move into a regular-level mathematics class the next year. The intent of the ESC was to help students close the achievement gap and develop skills foundational for future success.

These students believed their grades would improve based on the curriculum developed for this class. In particular, by adjusting the curriculum to include concepts of a difficulty range that challenged the students but within which they could experience success, students stated that they could understand the mathematics content of the course. The teacher presented these concepts in a fashion they could grasp at a pace slow enough to understand yet quick enough to align with the concepts of the other ninth-grade classes. Mastering these concepts within their current capacity to succeed gave the students confidence to set higher academic goals.

*Confidence.* The last open code, *confidence*, helped reveal the axial code *pace*
Students with low confidence often present low levels of self-efficacy (Everingham et al., 2017). These students understood their low ability and expressed their poor ability in interviews in the pre-implementation phase. I found, however, that expressions of low confidence change with students’ statements like, “I have the confidence” or “I can do this,” or “I know what’s going on.”

In the pre-implementation interview, the students expressed their frustration with the ninth-grade mathematics content. I asked, “What experiences have affected your confidence in math?” Students commented:

**Lincoln:** Math is hard. Like no matter how hard you try, I can never understand it.

**Lacey:** It’s hard. I just don’t really get it.

**Marco:** Like just like how hard [the other mathematics class] was. It’s been happening like since seventh grade. I’d look at it and it’s like “there’s no way I’ll pass this class.”

In contrast, these same students stated in their third interview that they believed they were learning mathematics in the ESC. I asked, “How is math class going this year?” These same students stated,

**Lincoln:** I like it. It helps me learn what you have to know...[Ms. Green] like teaches specifically on what you have trouble on. So, like, yeah, what you have trouble on.

**Lacey:** I feel more confident in this class than in the other one because I’m getting more help than I would in the other class.

**Marco:** I feel good about it...it’s helping me. The gaps that I didn’t know about math, they’re like that math class is helping me and I’m noticing that it is helping me a lot. I’ve been doing homework. It’s been getting easy. I’ve been getting like finishing the homework really quick.

Ms. Green explained, “One advantage or opportunity is that [the ESC] allows [the
students] to be able to fill some of the gaps that they have to feel more successful ...and
be able to build confidence.” Everingham, Gyuris, and Connolly (2017) recognized that
the lessening of anxiety and the increase in experiences that raise confidence also
increase self-efficacy. She observed that students “stop working when the math is so hard
or so above their ability that they can’t even understand the basics of it.” Adapting the
pace and content of the core provided structure within which these students perceived
success. Establishing a pattern of success built confidence and increased their emotional
engagement with the mathematics. (Bandura, 1994) explains this process as follows:

A resilient sense of efficacy requires experience in overcoming obstacles through
perseverant effort. Some setbacks and difficulties in human pursuits serve a useful
purpose in teaching that success usually requires sustained effort. After people
become convinced they have what it takes to succeed, they persevere in the face
of adversity and quickly rebound from setbacks (pg. 1).

Hayden felt that by learning fewer concepts in depth in the ESC provided a better
understanding of the material. He said, “You learn the material and the kind of subject
um, really like in detail so I um, I know what’s going on.”

The types of participation or the degree of the participation that the students
exhibited seemed to indicate changes in their confidence. As the study progressed,
students participated more willingly and without argument.

Videos of the observations showed all students in the ESC raised their hands to
ask or answer questions appropriately at different times. All five of the students
interviewed eventually developed the confidence to show their work to the class. Marco
and Hayden expressed that the importance of this adapted curriculum helped them
develop the confidence they felt they needed to participate.
Marco: This class takes it slowly, like, we’re like behind obviously, but she teaches it more. She reveals more, not like the normal class that speeds up, and not one-by-one. Like this class goes back, reviews, takes it slow and like that’s what helps me.

Hayden: [I am] better at math than before because, before, it was going a bit too fast for me and I was like full of pressure and stuff to get all of the assignments done. This class is a lot more chill.

In his third interview, Marco expressed his confidence when I asked why he described his third term mathematics experience as “pretty good.”

Marco: I understand math now.

Researcher: You didn’t before?

Marco: No.

Researcher: Ever?

Marco: Well I kinda did, but I didn’t understand, like, the gaps in math.

Researcher: So, you’re filling them in?

Marco: Yeah, now I’m nailing my tests and last term I passed with a B...

Researcher: ...How do you think you will do in term three?

Marco: Probably an A.

When Lacey stated in her third interview that she wanted to be a “marine biologist,” I mentioned that she would have to study a lot of mathematics. She laughed and said, “That’s OK.” She had developed an optimism of future success; they did not avoid considering careers that included mathematics.

Ms. Green noted that adapting the class content allowed students to develop confidence in a few areas where they felt safe with their peers. Ms. Green observed that this confidence in mathematics associated to more confidence in other areas.
Ms. Green: Confidence builder is a huge thing. Every year I hear stories of how this class has helped students gain the confidence and it translates into all of their class in school and their social just because of math....

Researcher: Can you give examples of this change based on the five selected students?

Ms. Green: ...One [student] in particular, had failed, struggles at home, mom gets frustrated, and he comes in here and he is kind of the leader. Kids go to him for help. He knows he almost kind of can work ahead sometimes. Still challenged. Still struggles to keep that organizational skills, but he has definitely become a different kid in his self-confidence from being in this class.

Researcher: How does that self-confidence manifest itself?

Ms. Green: His grades are much higher. His missing assignments are almost none compared to the struggle of that first term. The one I’m thinking of wasn’t my student first term, so I just hear that from him and his parents and the previous teacher. The kid they describe isn’t the same kid that I have...

I found that students expressed their perceived success in terms of what Ms. Green expected them to master. Even when they mastered fewer concepts than their peers, they seemed to develop a surety in their present and future academic ability over the course of the study.

Challenges of absenteeism. The axial code challenges of absenteeism relates to teacher-curriculum effect as Ms. Green and two of the interviewed students expressed their inability to learn the content when frequent absences occur. Ms. Green also mentioned that one of her frustrations as a teacher was how often students at this level are absent and how absenteeism ties to students’ success and motivation. She mentioned that she can change the instruction and help students, but “if the students are not in class,” she cannot help them. She stated, “Students that are absent a lot definitely struggle with that, being successful.”

These students stated that in prior mathematics classes, they encountered
frustration and resignation. With the adaptation of the course content in teacher-curriculum effect, students’ perceived success in this class and in future mathematics courses as well. However, when students frequently missed class, they stated that they were not able to interact with the teacher and curriculum, preventing them from developing this same sense of success.

In his last interview, I asked Lincoln if he thought he would pass this mathematics class in spite of a prolonged absence just before the interview. He said that he thought he would. I then showed him five cards listing the options for tenth-grade classes. I asked which class he thought he would take in tenth grade and he pointed at the card that listing this same ninth-grade class. I asked him why he would retake a class he thought he was going to pass.

Lincoln: Because it’s the best thing that I’m good at and I know what to do.

Researcher: So do you want to learn something new next year?

Lincoln: No

Researcher: What are your plans in high school?

Lincoln: Do good.

Researcher: Do you plan on graduating.

Lincoln: Depends.

Researcher: Depends on what?

Lincoln: My grades. How I feel about two more years, three more?

Researcher: Yeah, three more.

Lincoln: Three?

Researcher: Right now, do you think you’ll graduate?
Lincoln: No.

Researcher: Gonna drop out?

Lincoln: Yeah

In prior interviews, he explained that he was motivated to succeed; he was completing extra packets to make up past credit deficiencies, hoped he would get an A in later terms, and hoped he would show proficiency on the state-mandated end-of-year test. After his two-week absence, he no longer had the same perceived sense of future academic success.

Lincoln was the only student of the five that indicated that he probably would not graduate from high school. His extended absence seems to have altered his previously optimistic view. Although I did not directly ask about attendance in this interview, Lincoln mentioned five times that his greatest challenge to staying focused in school related to absences. He explained, “Before I had my surgery, I was pretty confident because I was there every day, paying attention and doing the work and everything, but the surgery, being absent made me lose the confidence.”

Self-efficacy and engagement in teacher-curriculum effect. Self-efficacy, engagement, and confidence are closely related (Dogan, 2012; Everingham et al., 2017; Wilds, 2014). Students in this class expressed an increased self-efficacy because they could understand the fewer concepts presented at a slower pace. Ms. Green noted her perceptions of the growth in her students’ self-efficacy as she taught only the essential standards. She explained, “One advantage or opportunity is that [the ESC] allows [the students] to be able to fill some of the gaps that they have to feel more successful ...and
be able to build confidence.” She observed that if students stop working out of frustration, adapting the pace and content of the core can provide structure within which these students can perceive success. (Bandura, 1994) explains this process as follows:

A resilient sense of efficacy requires experience in overcoming obstacles through perseverant effort. Some setbacks and difficulties in human pursuits serve a useful purpose in teaching that success usually requires sustained effort. After people become convinced they have what it takes to succeed, they persevere in the face of adversity and quickly rebound from setbacks.

I found changes in self-efficacy related to student emotional engagement with the mathematics and vice versa as illustrated above. This agrees with the findings of Midgley, Feldlaufer, and Eccles (1989) relating a perception of success to a positive change in student self-efficacy. The students’ perceptions of their mathematics ability improved over the course of the study. Initially, they described it as “bad” or “not good.” After four months, the five students described their ability as “pretty good” or “getting better.” In the last interview, three of the students explained that students had to “work hard” and “persevere” to gain mathematics ability. This indicated that they perceived any improvement in their ability, at least in part, resulted from their own efforts.

The five students noted that they participated more in this ESC when they understood the content. They also stated that they understood the content better when they participated more fully in the class. My analysis of these data found that as self-efficacy changed positively, cognitive engagement in the ESC also changed positively.

Cognitive engagement refers to the goals and emotions students establish when dealing with learning. Through my analysis, I found that students’ cognitive engagement changed, as evidenced by their academic goal setting and by the fact that their
mathematics deficiencies did not keep them from setting higher achievement goals. I found students illustrated a change in how they addressed mathematics challenges. They illustrated cognitive engagement with their perceived ability to persevere using a variety of methods to solve mathematics challenges instead of resorting to a single process or method.

Open codes from interviews and observations relate to emotional engagement which Dogan (2012) defines as “a reaction to or feeling about a student’s current or previous experiences with mathematics” (p. 8). The open codes relating to pace and content indicated a change in students’ perceptions about mathematics and their ability. Students demonstrated emotional engagement when eight of the 23 students enrolled in the beginning of the study excitedly volunteered to go to the board and groaned when they were not selected to show their work. While I observed this as positive initial participation, 15 of the students did not actively participate at any time during that observation set. By the end of the study, I had observed all 23 students had worked problems at the board for the class.

In summary, the axial codes pace and content and challenges of absenteeism related to teacher-curriculum effect in that students perceived that they experienced academic success because of the teacher’s adaptation and adjustment of the state core to meet their needs. As they perceived this new success, they developed optimism in their future academic pursuits. They also stated that they gained confidence in their perceived ability, which increased their desire to engage with the mathematics. The teacher and the students also mentioned that absenteeism also influenced their self-efficacy and desire to
engage in class as they often felt overwhelmed by the academic expectations when they returned to school.

**Peer-Curriculum Effect**

Figure 3 shows two axial codes related to peer-curriculum effect: (a) *peer perceptions*, and (b) *peer responsibility*. The open codes that revealed peer perceptions were (a) *comparative ability*, (b) *class comparison*, and (c) *placement*. The open codes that revealed *peer responsibility* were (a) *positive/negative engagement*, (b) *peer support*, and (c) *leadership*.

How peers react to and interact with curricula is an important element in building a relationship with the emotional and academic development of middle and high school students. The five selected students all stated in their interviews that their peers had little effect on their performance and how they engaged cognitively and behaviorally in the class. This, however, contradicted what I noted in the observation memos and video codes. These academic interactions among students with their peers in the class changed over the course of the study.

**Peer perceptions.** The axial code *peer perceptions* emerged from the open codes relating to peer-curriculum effect that evolved from Phase I to Phase III of the study. The open codes illustrated two main comparisons discussed by the students (a) *comparative ability* (b) *class comparison*, and (c) *placement*.

**Comparative ability.** Researchers have found that students will bully or harass students in low-ability classes and that students in an ESC-type structure will develop an even lower self-concept (Boaler et al., 2000; Mills, 1998a; Oakes, 2008). In interviews, I
asked students how their ability compared with that of students in other classes. Hayden and Marco acknowledged that they were “behind” or did not “learn as much” as the students in a regular-level class, but they both felt that they benefitted from the ESC because they said they were “understanding the math” and “finally getting it” (respectively).

Concerned about how peers in regular-level classes interacted with students in the ESC, I asked Ms. Green if she perceived the students having negative reactions to placement in lower-level classes. She explained,

I don’t think it does at all. In fact, I think it does the opposite.... A lot of students actually feel really relieved.... It’s usually not a negative at all. Usually, like I said, it’s a sigh of relief. It’s a load off of their back. It gives them the confidence. It’s a class that they feel and know that they can succeed in.

Contrary to having a negative reaction to the ESC placement, Marco expressed concern that teachers would re-enroll him in the regular-level class as shown below:

Researcher: So why would you not be in this class?

Marco: Maybe ‘cause I get to the point where I understand math and they want to step me up to the regular one.

Researcher: Do you want to go back into the regular class.

Marco: Naw.

Researcher: How come?

Marco: It’s too hard.

Researcher: What makes it hard?

Marco: How they go fast and they don’t review right away. It’s just they keep going.

Researcher: Why do you think that they go so fast in the regular class?
**Marco:** ‘Cause the students understand more.

After another month in the class, Marco stated that he felt ready to enroll in a regular-level tenth grade class without additional support interventions. I asked why he felt he would be ready for this higher-level. He explained, “Because I been understanding math, like, really good (sic). I don’t wanna, like, I wanna have a challenge next year.” I found that his perceived ability had changed his outlook and, this change aligned with his desire to continue to improve.

These findings differ from prior findings that indicate student placement in low-ability classes negatively affects the students’ self-concept and lessens their desire to participate due to the embarrassment of the placement (Boaler, 2015; Burris et al., 2008; Levario, 2017). In this study, students SBGL in mathematics expressed greater willingness to participate and attempt more challenging work in the future. Ms. Green explained her observations about how students perceive their placement in the ESC.

Most of [the students that transfer into the class] are pretty excited to be placed in the class. I think they realize that it’s an opportunity and when they are in the class, most of them excel. They become leaders. They are able to be successful. It’s something that some are hesitant in the beginning, but most aren’t. I think again, that they realize that’s a place to help them.... Most of the kids are willing to work and will work and have hard working are persistent. They’ll try it. Rarely do I get kids that say I won’t even try. Those are not the kids we’re looking for. We’re looking for the kids who are willing to work hard and will stick to it. Those are the students we can help right away.

I found social comparisons depended on how students defined their peers. Within the ESC, I found social comparison appeared healthy as students perceived their ability comparable to their peers. Once they extended the peer group to other level classes, they perceived their ability a “low” or “bad.” When asked how Marco perceived how his peers
felt about his mathematics ability, he explained the following:

**Marco:** Kids tell me, “Oh you’re dumb?”

**Researcher:** Does that happen a lot?

**Marco:** No, but I don’t take it personal, cause I know they’re joking around, but I feel like I am. When I do something wrong, I feel like I’m dumb. I don’t know.

In this ESC, he described his ability as “not professional or bad at it. I’m just in the between.” When I asked Marco if he believed that some students were born better at mathematics than others, he stated the following:

**Marco:** Yeah.

**Researcher:** Why?

**Marco:** I believe that kids like they don’t even ...the teachers don’t even have to explain They just do it really quick and then they’re done.

**Researcher:** How does that make you feel?

**Marco:** Dumb.

**Researcher:** Do you think that’s fair?

**Marco:** (long pause) Yeah, I think it’s fair. Everybody’s different. They think different. Just I need a little help more. Some people are like more, more, how do I say it like, more up in the level. Some people are like more down. It’s just everybody’s different. They need help.

Marco intimated that mathematics ability was being able to “do it really quick.” He added though that mathematics achievement is a blend of ability and effort. He believed that students receive different capacity for learning, but the success comes with the effort expended. As the students described their differences in ability compared to their peers, they all acknowledged the differences arose from how peers interacted with the content and the responsibility for each student to work for success. Marco, like the
other interviewed students, expressed no shame in attending the ESC as a lower-ability student. He perceived it, rather, as where he could receive the tools to help him work to make his ability equal to his peers.

**Class comparison.** Another open code relating to the axial code of peer perceptions is class comparison. All of the selected students SBGL in mathematics maintained that they needed, wanted, and received help in this ESC structure. Students understood there were differences in the curriculum, structure, and expectations of the class. The students stated this was a benefit for them, but also noted the disadvantages of this placement.

In their pre-implementation interviews, none of the students expressed any negative aspects of enrolling in the ESC. They only recognized the help they would receive. After the four months of the study, Hayden recognized the students in the ESC did not learn as much as their peers in the regular-level classes learned. He explained one of the things he disliked about the class as follows:

**Hayden:** Probably that some of my other friends that are in different classes ask me for help on a problem on their homework. And I’m like, ‘I don’t know how to do that one.’ It’s kind of like, dang it.

**Researcher:** Would you like to learn that stuff?

**Hayden:** Yeah.

In the final interview, he said that he was ready for a regular tenth-grade mathematics course without additional interventions. I asked why he perceived this more difficult class would be appropriate. He said, “Because I’ve done this class for about a year and a half now and I think I’m ready to go into that.” Rather than feel disadvantaged
by the placement in a low-level mathematics class, he perceived the class had prepared him for the challenges of a higher-level mathematics class with his other peers.

**Placement.** The third open code to relate to peer perceptions was placement. Peer-curriculum effect deals with how students and peers interact with their academic performance and the curriculum. In middle school, peers play a particularly important role in academic engagement (Christenson et al., 2012). I found that peers influenced cognitive engagement and behavioral engagement in the class and how the students chose to participate. Placement into the ESC, however, must consider this peer influence. Ms. Green stated,

> [The class] works. It’s something that we’ve seen the students grow—not only math skills, but as an individual and be able to build confidence...I just think that if students are placed correctly this is an awesome class and an awesome place for them to be successful.”

In spite of the success she perceived students have had in this class, she explained that the class would not be a good placement for all students. She continued, “I don’t think it would be right even to say this class would be good for all struggling students.” Ms. Green described another source of frustration as “kids that are incorrectly placed.” She described the many interventions in place at this middle school to help students determined by their needs: “FLEX time (30 minutes each day for students to meet with teachers), daily dose, labs of different types.” Entry in to school interventions considered student background experiences, student performance scores, and other data evaluation. Ms. Green described the considerations taken when recommending students for the ESC.

**Ms. Green:** Making sure going back in their background. What are their [end of year test] scores? What have their past grades been like? And sometimes kids fall through those cracks or are misplaced and maybe too high for the level of the
class.

**Researcher:** So how do you take care of that problem?

**Ms. Green:** We try to do a pre-test at the very beginning of the year to kind of see where they are. Anyone that is on a higher level than that kind of gives us a communication with the parent and the students or to kind of watch for them to be able to gauge that throughout the year. Every year we’ve had kids that we’ve had that as they’re coming in, we’re moving back out for several different reasons. Some ability. Some behaviors.

**Researcher:** Do you feel that this process is fair?

**Ms. Green:** We try to make it as fair as possible. Again I also think that there are so many things that we don’t see and understand. What’s happening at home: What’s happened in their background? But we do make sure that we have tried other things before we put them into the Essentials’ Class.

She later added, “I think we also need to realize that just because they’re in this class doesn’t mean that that’s the perfect place for them.” She explained that if the ability of the student is too high, he or she could experience conflict arising from boredom. She perceived one of the ways to avoid boredom-related behavior problems is, “Just making sure that they are always being challenged...Being able to move students in and out and kind of have that fluid is something that’s key that we really work on.” In other words, students who no longer find a challenge in the ESC should move to a more appropriate level mathematics course.

For example, when the class became too elementary for Henry, he caused class disruptions. His peers observed that he completed his mathematics work easily although behaving inappropriately and they followed his negative example. Moving him out of the class when he became more mathematically capable corresponded to the reduction of the number of negative behavioral engagement indicators for some students.
Ms. Green described the students she believes should enroll in the ESC.

This class is a class where we’re looking for kids that have no number sense, that common sense that so many of the advanced students have that these kids don’t have. They’re hard-working kids that have struggled, but there are so many gaps and so many different areas that they don’t understand.

Ms. Green contrasted the students who struggle but try with students who struggle but create class management problems. She stated that students who “have always ...been able to misbehave in class” cause problems when grouped together in a “high demand” class like this ESC. Peers reacting negatively to a curriculum can create social pressures to misbehave, so peer-curriculum effect can negatively impact the structure of a classroom if not monitored carefully.

Initially, students stated, “Any student who struggles (needs help) should take this class” and “students who don’t get it.” When asked if they would recommend the class to their peers in the beginning of the study, the five students stated they would if those students “needed more help in math.” In later interviews, they recognized that students bore some responsibility in their own performance and should behave appropriately in class. In these later interviews, the students explained that all students in the ESC should “do homework,” “not goof off,” and “listen to the teacher.” They further explained that other students who did not fulfill these expectations should not enroll in the class or should not be allowed to stay enrolled.

I asked Ms. Green, “Isn’t it a way for kids to take an easy class and get an easy credit?” Ms. Green replied, “

For a lot of them, it’s still not easy. And it shouldn’t be easy...Because of the way the class is structured, their engagement in class is much higher than in a regular class. The ability to focus and stay on task is something that is expected and
something we cater to to kind of help those kids.... We had a student in the class and I felt that she could do more and have a higher (sic) and be able to be challenged. I talked to her and we put her in the other (regular-level) class and she’s done phenomenal. And you really can’t even tell that for a good term, she was in the Essentials class. She’s one of my top students in my regular class.

**Researcher:** How did she end up in the Essentials class to begin with?

**Ms. Green:** She was struggling. Math was hard. It was taking her a lot of time to do her homework. Mom was complaining, went to the counselor and the counselor made that change.

**Researcher:** Without the process you described earlier?

**Ms. Green:** Correct.

In spite of the need for proper placement, parents or counsellors may insist on enrolling some students in the ESC to diminish struggle, avoid the rigor of mathematics, or simply to be with friends. Students who are not placed in a class with appropriate rigor can miss reaching their potential as a result of receiving a limited curriculum. They can also cause teacher frustrations because of misbehavior in a class that does not provide appropriate rigor. Proper placement can alleviate some of those frustrations associated with peer effect.

**Peer responsibility.** The other axial code relating to peer-curriculum effect is *peer responsibility*. The open codes that emerged during the study included (a) *positive/negative engagement*, (b) *peer support*, and (c) *leadership*.

**Positive and negative engagement.** Students interacting with their peers in the class exhibited a change in their interactions. I found these changes in the number of positive and negative behavioral engagement indicators during the observations over the course of the study.

I found an increase in the ratio of positive class interactions to negative class
interactions over the length of the study. Positive memos from the first and second observations include “volunteered to go to the board,” “raised hand to answer a question,” and “followed instructions.” Negative memos from the first and second observations included students “off-task and distracted by peers,” “misuse of tools—tapping, throwing, hitting with rulers,” and “students wandering” during the lesson. Positive codes from the first and second observation videos included “positive—helping with a problem,” “positive—following instructions,” and “positive—volunteer/hand to participate.” Negative codes from the first and second observation videos included “negative—verbal distraction with peer,” “negative—wandering,” and “negative—misuse of tools.” Table 6 shows the positive and negative totals for each observation set for each observed student as well as the length of the video clips and the memos about the recordings. The word “None” indicates the student was absent the days of the observation set.

Because I had comparable length videos of Lincoln from the first and second observation sets, I counted his positive and negative interactions in each to compare the change. If coders noted similar events within two minutes of each other, I counted those as the same event. For example, if Lincoln tapped a ruler five times in 2 minutes to create a distraction, I counted that as one event rather than five. Likewise, if coders noted that Lincoln was “watching teacher” as a positive event looking up and down during a 2-minute time span, I counted that as one event.

Lincoln’s positive to negative ratio of class interactions in November was 49:60. In January, coders noted fewer events with a positive to negative ratio of 47:18. Lincoln’s
Table 6

<table>
<thead>
<tr>
<th>Student</th>
<th>Observation set</th>
<th>Time</th>
<th>Positive engagements</th>
<th>Negative engagements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hayden</td>
<td>1</td>
<td>14:32</td>
<td>18</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>25:39</td>
<td>23</td>
<td>4</td>
</tr>
<tr>
<td>Marco</td>
<td>1</td>
<td>30:45</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>49:00</td>
<td>37</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>13:42</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>Mason</td>
<td>1</td>
<td>33:23</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>56:52</td>
<td>35</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>26:25</td>
<td>24</td>
<td>13</td>
</tr>
<tr>
<td>Lacey</td>
<td>1</td>
<td>35:32</td>
<td>21</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>16:18</td>
<td>26</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>39:45</td>
<td>38</td>
<td>10</td>
</tr>
<tr>
<td>Lincoln</td>
<td>1</td>
<td>54:04</td>
<td>49</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>2</td>
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<td>47</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Note. “None” indicates that the student was absent for both days of the observation set.

most commonly noted negative code was the dress code violation when he wore his hoodie over his head in class. Because of the frequency of the code, I did not count this in either observation towards the negative count of his events. I found, however, that by the last interview, Lincoln rarely wore his hoodie over his head in class.

In the first observation set, I memoed eight main events of students off task including “hitting peers with rulers,” “chatting during lesson—verbal distraction,” and “switching seats.” In the second observation set, I noted only five similar negative events noting the “class as a whole on task.”

Figure 4 shows the entire class in the second set of observations making foldables to help them study the features of functions. The observation memos state, “all students
engaged in task as teacher gave instructions.” The students showed behavioral engagement as they used similar tools (pencils, papers, rulers, and scissors) as in the first observation, but only twice during this task did the students throw a ruler or tap the rulers to distract their peers. They also engaged cognitively as they actively participated in the lesson and helped each other complete the assignment.

Memos note that a student was “tapping from tick?” This indicated that I perceived the student expelling energy subconsciously and not to distract the teacher or others. The memo also noted that the student was “fidgeting in his seat.” I observed that students often shifted their positions, drummed their fingers on the desk, and bounced their legs up and down as if burning off excess energy. These actions collectively indicated that the student might not have consciously tapped the ruler as a distraction.

**Peer support.** The open code *peer support* revealed the axial code *peer responsibility* in that I found students in the ESC turning to each other for support and help. Observation memos and codes showed students supporting each other by clapping, verbal encouragement, and providing mathematics instruction. These observed changes accompanied students’ statements of “I got this,” “let me show you,” and “you’ve got this.”
I found that the students perceived this same sense of community support when students in the class showed their work at the board. Hayden stated these common ideas when I asked about class participation.

**Researcher:** What would make someone raise their hand in class?

**Hayden:** To share with other students so they can all like have the same idea.

**Researcher:** Why would you raise your hand to participate?

**Hayden:** I guess I like raising hands and stuff and helping those that need help and helping the teacher.

**Researcher:** So helping other people is why you participate?

**Hayden:** Yeah.

**Researcher:** What do you think when one of your friends raises their hand or goes to the board?

**Hayden:** I think like, heck yeah! They got this. Nice. Yeah.

Marco’s behavior during the second observation could be construed as dissocial as his comments distracted students during the lesson. Memos, however, showed that his girlfriend had recently enrolled in the class and chose to sit next to Marco. He talked often to explain or teach a concept that she or others did not understand. Marco later explained that when he showed others how to solve problems, it helped him develop confidence in his own ability.

**Researcher:** Why would you volunteer to go to the board?

**Marco:** ‘Cause ...it’s easy and I show my classmates how to do it.

**Researcher:** It’s important for you to be able to show?

**Marco:** Yeah.
Researcher: How do [other students] feel about you when you go to the board?

Marco: I don’t know.

Researcher: What do you think?

Marco: Like, I don’t know. Like, they’re probably, like, so like, I saw him do that so I should do that on mine. Like on the problem.

Researcher: What do you think when somebody else goes to the board?

Marco: Well, if they do it wrong, I think it’s like better ‘cause it shows the mistakes and like, oh, we don’t do that so we won’t do that again and it shows me how to do the problem.

Researcher: When somebody does the problem wrong at the board, you think it helps you more?

Marco: Yeah, ‘cause it’s like mistakes and like um, I’m like, “You don’t do that in the problem” so I don’t do that and I should find another way to do it. Or like I should do what he does, or she.

These codes illustrated how students wanted their peers to succeed in the ESC. They worked together to support each other verbally, physically, and academically. These illustrations of support are closely tied to the next open code relating to the axial code peer responsibility as shown in the next section.

Leadership. Closely aligned with the concept of the development of student community support in academic responsibility is the open code leadership. Ms. Green commented on this development of student leadership contrasted with what she observed of students with lower-ability in her regular-level mathematics classes.

Something that I don’t think that any of these kids would have ever been able to step up to in a regular class. They’re helping others. They’re realizing that other students are having some of the same questions that they have. It gives them a confidence that [they can ask] questions and have them answered.

The observation video showed Mason explaining the features of functions to his
neighbor who had misunderstood Ms. Green’s explanation. Mason then assumed a leadership role and rose to help a girl in the next row put together her foldable. I also observed a change in Lacey’s interactions from the first observation set. While she behaved appropriately during the majority of the first observation, her motivation to comply with norms and participate in the class seemed to be to garner teacher approval and affirmation of her work turning only occasionally to her peers. By the middle of the study, she had developed more autonomy in her actions. By the end of the study, the ratio of teacher-to-peer interactions (both physical and verbal) had changed significantly. In the first observation, her teacher-to-peer interactions ratio was 52:20. By the last observation, codes revealed teacher-to-peer interactions ratio at 23:34. The interactions with her peers would not always be construed as positive academic interactions (laughing and talking about non-mathematics subjects), but I found her actions aligning with her social engagement in the class.

In the third observation set, I observed her explaining a concept to a peer across the desks at the same workstation. When he seemed still not able to understand, she said, “Bring your desk over here so I can help you.” Figure 5 shows Lacey as she spent the next eight minutes working with him to complete the task. During this time, she turned to the teacher for support, but only to verify her answers. Instead of asking how to solve the problem, she stated, “Don’t you put the two in there and get (inaudible)?” At the end of the third observation set, I observed Lacey volunteer for the first time to go to the board to demonstrate her work to the class.

I asked Lacey what she thought the other students thought when she went to the
board that day. She explained, “Maybe some people won’t care, but some people will. Like they know that I’m trying like another student is trying their best.” She then described the she feels encouraged when others go to the board and she felt the responsibility show that same example. She said:

**Lacey:** ...If I got up to the board, the people who are struggling, like, I can kind of help them I guess....

**Researcher:** What do you think when someone else goes to the board?

**Lacey:** I think that they’re trying and when they get it right and they know it’s right, they feel good to know how to do it.

**Researcher:** Do you feel that good feeling also or does it not affect you if they get it right.

**Lacey:** Yeah, I get a good feeling ‘cause if they know how to do it then I know that I can do it too.

I then asked Lacey if she participated more in the ESC than in her previous regular-level class.

*Figure 3. Lacey helps a student with a task.*
Lacey: Yeah, kind of. It’s like in the middle. ‘Cause in my old class. The teacher would always call on me to do it. I wouldn’t call. But now like I call for myself.

Researcher: What would make you want to participate?

Lacey: Like, so, I feel confident when I know the answer and I do. That’s, like, when I want to participate.

Researcher: What would make you want to go up to the board. If you know the answer, why not just sit and let someone else do it?

Lacey: I don’t know. Like sitting, I feel like I don’t get out of it as much. Like I won’t get as much stuff done?

Lacey perceived that her behaviors related to her understanding. If she did not participate, she would not learn as much. By the end of the study, she had assumed her responsibility to her peers by participating in the class. She perceived that participation facilitated her learning. I found Lacey demonstrated less dependence on the teachers and their approval and seemed to engage socially more with the mathematics by answering questions in class, helping other students with their work, and working problems for the class at the board. Her actions indicated that her perceived role in the class changed from help-seeking to assuming a responsibility to her peers to offer them help.

This change from wanting and needing help is similar to the change observed when students assumed the role of leader in the classroom. Ms. Green noted a similar situation with a different student. She said,

Leaders come out. We get to see kids coming up to the board that would have never done that. I had a student, [her] first day into the class, I said, “You’re coming up to the board. You would never do that in the other class.” She said, “Oh no, it would be way too scary in the other class.” But she knows that this is something she can do and she would come up to the board on a regular basis.

**Self-efficacy and engagement in peer-curriculum effect.** Because self-efficacy, engagement, and confidence is often linked together (Dogan, 2012; Everingham et al.,
students’ expressions that they experienced more confidence interacting with the mathematics in the ESC illustrates the link to self-efficacy.

For example, Mason explained, “Like, so, I feel confident when I know the answer and I do that’s, like, when I want to participate.” These perceptions were echoed by all the students in their interviews. Lacey stated, “I feel more confident in this class than in the other one because I’m getting more help than I would in the other class.” Because mathematics self-efficacy is the perception of one’s ability or competence to complete mathematics tasks, these statements show the students perceived a greater self-efficacy than they experienced in their regular-level classes. I found that students made more of these comments as the study progressed over the four months and these comments indicated an increase in their academic participation.

Their engagement indicators of working problems at the board in front of their peers and supporting class peers verbally, physically, and academically links their behavioral and emotional engagement to their self-efficacy also. This reflects the leadership findings in Big Fish Little Pond Effect (Duffy, 2007; Kalaycioğlu, 2017; Marsh & Hau, 2003). I found that students did not exhibit fear when working at the board, as they perceived a support system in the class (social engagement). A good example of a change in social engagement indicators is how Lacey increased the number of student-to-student interactions (academic and non-academic) inversely related to the number of student-to-teacher interactions.

She also exhibited emotional engagement in the final observation set as she confidently raised her hand and smiled as she explained her answer at the board. In the
final interview, she stated, “I get a good feeling ‘cause if they know how to do it then I know that I can do it too.”

I found that students SBGL in mathematics in this study exhibited no shame from their peers resulting from their enrollment in a low-ability class. Instead, these students expressed gratitude that they had the opportunity to “fill the gaps” they knew they had in their mathematics understanding. They recognized that receiving fewer concepts at a slower pace disadvantaged them when helping peers in higher-level classes, but they preferred their enrollment in the ESC, as they understood that this class placement helped them do that. As students perceived more success in the class, I found they assumed greater responsibility for their behavior and their academics. This responsibility extended to supporting other students and assuming a leadership role in the class.

In summary, the axial codes peer perceptions and peer responsibility related to peer-curriculum effect. Students perceived that their peers did not condescend when recognizing student participation in the ESC. Additionally, when students compared academic abilities, they most often did so within the structure of the ESC limiting academic differences. Furthermore, as students perceived an increase in their ability, their help-seeking behaviors transitioned from seeking help from the teacher to seeking help from their peers. This then later transitioned to assuming a leadership role in the classroom and assuming a responsibility to help their peers in the ESC learn mathematics.

Peer Effect

Peer effect differs from peer-curriculum effect in that peer effect deals with the positive and negative social and cultural relationships within a group (Bandura &
Barbaranelli, 1996; Gaddis, 2013; Shim & Finch, 2014; Yonezawa et al., 2002). Four of the selected students stated that peers were the least influential of the effects in this study related to students’ learning. The observation memos and codes from recordings and interviews, however, revealed students spending a large amount of time watching and reacting to their peers, especially at the beginning of the study. Figure 3 shows a singular axial code related to peer effect: *peer influence*.

**Peer influence.** The axial code *peer influence* related to peer effect in how students’ relationships correlated to their academic and social experience in the ESC. The open codes that related to *peer influence* included (a) *desire for acceptance*, (b) *peer influence on behavior*, and (c) *peer motivation*.

In the final interview, I gave the students four cards listing each of the effects (teacher, teacher-curriculum, peer-curriculum, and peer). I then asked the students to place cards in order of perceived influence on their academic experience. Four of the five students placed peer effect as the least influential effect.

Lincoln did not perceive his actions in relation to his peers, rather he regarded peers as a resource. He said, “Depends on how much they (the peers) want to work and help you.” Marco stated, “[Peer effect is] the least. If your peers don’t like you, that’s the least thing to worry about because you’re not like really, you don’t need to care about what they think, but you need to care about your assignment.” He perceived peer effect in how he reacted to his peers’ perception of him rather than how peers affected his behavior. My findings, however, indicated peer effect played an important role in the emotional and social engagement of the students in the ESC.
Desire for acceptance. This code differs from peer perception in peer-curriculum effect in that it deals with how students change their actions based on their feelings of popularity and personality rather than as a reflection of the class placement or mathematics ability. When I asked Mason how he felt about attending a lower-level class where he received less content, I anticipated he would explain how peers reacted regarding peer-curriculum effect. He explained, however, “It’s (the class is) just the one for me. I feel like I just fit in there.” His desire for belongingness surpassed his perceived need for academic support. He stated that he wanted to “fit in.”

Another example of students reacting to peer effect and belongingness occurred in the first observation set. Marco wandered to the pencil sharpener while Ms. Green led a discussion on graphing inequalities. While at the pencil sharpener, Marco distracted the boys nearby with comments and conversation. The observation memos describe a domino effect of disruption. “Donald flips off Marco and then Mason. Mason laughs/flips off Steve. Mason distracts other student showing him middle finger.” Figure 6 shows Mason drawing attention to himself after tapping on the shoulder of the student next to him. During the follow-up interview, I showed Mason the video of this exchange.

I asked Mason,

Researcher: At the beginning of the clip, it looks like you’re working pretty hard. You’re graphing and following instructions. Then what happened?

Mason: Then I got bored.

Researcher: What did you do?

Mason: I goofed off.

Researcher: In what way?
Mason: In very crazy ways.

Researcher: You said you got bored, but is there another reason why would do those crazy things?

Mason: I just met these friends and I wanted to make a good impression on them.

Researcher: So making a good impression on them by doing what you did in the video clip?

Mason: Yeah.

Researcher: Did that help you make a good impression?

Mason: Kinda, yeah.

Upon closer inspection, Mason did not actually show his middle finger. He raised his fourth finger, but did so, as he explained in his interview, in an attempt to garner acceptance into this group. I found him attempting to fit in with a new peer set while attempting to conform to social norms of not using his middle finger.

*Peer influence on behavior.* Closely related to students’ actions to achieve a
perception of belongingness, the open code *peer influence on behavior* also relates to the axial code *peer influence*. In the first observation set, I found students challenged the teacher’s purpose in her lessons. I watched students misusing tools as they tapped rulers on desks. I heard students whistling during the lessons. I saw students rise and wander around the room or to the bathroom in the middle of class.

Although administrators intentionally kept the enrollment of the ESC below 30 students and they assign a paraprofessional to help with classroom management, Ms. Green stated that her biggest frustration in teaching the ESC is the number of behavior issues she has to contend with during instruction. She commented,

> When you stick...a lot of kids in high demand in a class like this, there’s a lot of behavior that we just really try to keep close eyes on. But there are a lot of misbehaviors. The other problem is kids that are incorrectly placed.... A good part of my classes are (sic) great; good kids who have always struggled in math. There are some that have that behavior, um, that struggle with behavior in class and staying on task. But again, the way that the class is structured, we try to avoid that. We keep them engaged, moving, working with somebody, coming up to the board so that those behaviors that are normally distracting are no longer there because they are able to be engaged in the topics that are being taught.

**Researcher:** How do you handle the misbehavior?

**Ms. Green:** We have a contract that the students and parents have at the beginning of the year that outlines the expectations of how and what and then each quarter, we review. They also are graded on their participation in class and so that will reflect as part of their grade so that we can document that and bring that up with parents...Most of the kids are willing to work and will work and have hard working (sic) are persistent. They’ll try it. Um, rarely do I get kids that say I won’t even try. Those are not the kids we’re looking for. We’re looking for the kids who are willing to work hard and will stick to it.

I found these students SBGL in mathematics had developed avoidance behaviors to evade mathematics encounters. Dissocial behaviors were common and the five students recognized the behavioral disruptions of their peers when shown the videos of
the observation. I found the students did not, however, perceive these negative actions significant enough to want to drop the class. Hayden acknowledged how his peers acted inappropriately in class, but stated, “Students misbehave in all classes, maybe a little more in this class, but not bad.”

In the first observation set, I found Lincoln’s behaviors reflecting the actions of his peers. Figure 7 shows how Lincoln (in the hoodie) participating in group dissocial behaviors during a task in the first observation.

Memos note that only three of the seven students in the group in Figure 7 engaged behaviorally with the task as the paraprofessional provided instruction and discussion. The other four in the group misused the tools provided for the task (blowing papers, tapping pencils, tapping rulers). The paraprofessional called attention to the disruptive behavior by calling on one of the students, but he ignored her and continued his disruptive behavior.

*Figure 5.* Peer influence adds to inappropriate interactions during a lesson task.
Throughout this class, Lincoln spent an inordinate amount of time watching and reacting to his peers, especially Henry. Lincoln had 13 separate and prolonged (more than one minute) verbal and physical peer interactions (talking, touching, answering/asking questions). Some of his actions were positive (getting help with the task) other actions were negative (laughing and talking off-topic). I found that these actions generally corresponded with whether his friends were on task or not.

In the interview following this observation, I asked Lincoln why his friend was tapping the ruler during the aforementioned task.

**Researcher:** Why do you think he was doing that?

**Lincoln:** He was trying to be annoying.

**Researcher:** Why would he do that?

**Lincoln:** Because he’s annoying.

Lincoln perceived his friend’s behavior as annoying, but he did not seem to recognize his own participation in the task distraction nor did he discontinue his participation of the annoyance when the paraprofessional called attention to the disruption. In the second set of observations, Lincoln’s ratio of positive to negative events improved as shown in Table 6. This observation occurred after teachers moved Henry to a regular-level class. When this peer influence was removed, Lincoln began to behave more appropriately,

**Peer motivation.** The open code *peer motivation* helped reveal the axial code *peer influence*. In academic classes, some may view non-academic student-student social interactions as negative. Ms. Green perceived that a greater sense of community helped
ease Hayden’s “mathematics anxiety,” the reason she gave for his enrollment in the class despite his comparative “high” ability. She perceived that these non-academic interactions created a positive and supportive learning environment for him to help him “build up his confidence.” I found Hayden’s social interactions influenced how his participation changed over the course of the study. I memoed in the first observation set that Hayden sat quietly and observed others but rarely interacted with his peers. He also stayed in the classroom with Ms. Green during the lunch break that fell in the middle of class. Later in the study, he started going to lunch with the other students in the class. The last observation set showed him socially engaged and helping other students with the class work. Observation memos note that these interactions were often with one girl, which may also reflect why he began to participate more.

Ms. Green had identified Hayden as a high-comparative ability student for the study. Similarly, his peers recognized his ability and often turned to him for help with their mathematics. About halfway through the class task in the final observation set, a student asked him for help. Hayden sat back and stated, “Naw, I’m going to finish it at home.” The student looked puzzled and Hayden said, “Just kidding, let’s get this done.” He continued to joke and work with his peers throughout the observation.

Marco explained how his peers motivated him after his frequent absences due to medical issues. He mentioned that friends made him “want to go to class” and helped “motivate” him to get grades caught up. He stated,

**Marco:** There are some times where I’m, like, going really good and then I miss a day of school or I get sick and I go down and it’s hard to go back up with my grades.
Researcher: Is it hard to get your grades up or is it hard to get motivated?

Marco: Motivated again. I just get to that point where I give up. But then I get that little help from someone or like sports that motivate me. Like, you’ve got to have your grades up.

I found the data about these student-student relationships showed how peer interactions associated with peer acceptance, social behaviors, and aligned with motivation amongst the students in this study.

**Self-efficacy and engagement in peer effect.** Findings from my analysis of these data showed an increase in self-efficacy. This was illustrated by the change in the self-efficacy students showed when volunteering in class and how students perceived their ability in relation to their peers. This change in self-efficacy also aligned with how students showed interest in and engaged more socially with their peers (Shim & Finch, 2014). I found that as students’ perceived self-efficacy positively changed, the number of prosocial interactions increased. A change in self-efficacy may also explain the change in Table 6 showing the change in the numbers of students’ positive and negative behavioral engagement indicators.

When asked why the students liked the ESC, they often stated, “I have friends in this class.” Regardless of how students perceived the influence of their peers on their academic performance, the data showed that peers have a substantial influence on how students perceive their acceptance, behavior, and motivation in the ESC.

I found over the four months that students stopped challenging the teacher by saying phrases like, “Why do we have to do this” or “What if I don’t want to?” Instead, they more readily complied with instructions and norms.
General improvement in social and academic indicators in the ESC related to behavioral engagement as students perceived that their actions affected their learning and the learning of others in the class. Findings from my analysis of behavioral engagement fell into two categories: students’ perceptions of their responsibilities in the class in understanding the mathematics, and students’ improved behaviors in the class. I found these behavioral changes related to students’ perceptions of their own actions in the ESC and their expectations of other students in the ESC.

I found that while student behaviors did not always focus academically, they smiled more and interacted with others more during class by the end of the study. The final observations showed students working quickly to finish tasks and homework to have time to interact socially. Because researchers identify emotional engagement through the responses students have to learning activities, their descriptions of the class as “awesome” and “great” indicated positive emotional engagement; in other words, happiness, excitement, and enjoyment (J. A. Fredricks et al., 2004; E. Kennedy, 2009).

I found students exhibiting these social engagement indicators throughout the study. Ms. Green remarked that Marco began to engage with the mathematics and help other students much more when “his girlfriend enrolled in the class in third term.” When Marco broke up with this girlfriend a month later, Ms. Green described him as “[moping] on the floor, refusing to participate.” She finally had to tell him to “knock it off” and he participated and complied with classroom norms again. This social influence directly related to his mathematics engagement.

Although four of the students stated their peers had little influence on how they
engaged with the class, Hayden linked peer effect with social engagement. He recognized that peers influence social engagement negatively with inappropriate behavior and ranked peer effect as the second most influential domain. He explained, “I think also peer effect is next (second) because friends are always like distracting you and stuff you can’t get any work done and it gets harder and harder.” Hayden noted how peers might negatively influence learning, but I found that peers could also directly influence positive self-efficacy beliefs and social engagement.

The findings for peer effect include the social influences tied to acceptance, behavior, and motivation of the students SBGL in mathematics in this study. Findings indicate that peer effect had both positive and negative influences on the behaviors in the class as students made efforts to “fit in” and “make friends.” When students appeared to be properly placed into the ESC, the findings showed dissocial behaviors waned in favor of prosocial interactions. Furthermore, findings agreed with prior research that positive peer interactions align with an increase in students participating appropriately and supporting each other in their learning efforts (Shim & Finch, 2014). These influences also aligned with the positive change in self-efficacy and engagement.

In summary, the axial code peer influence related to peer effect in that students perceived a sense of belonging in the ESC. As they perceived acceptance from their peers, their behaviors shifted to reflect class norms in relation to the behaviors of their peers. Students also illustrated increased motivation to work when they interacted more with their peers.
Summary of Axial Codes to Effects

I found two distinct axial codes emerged from each of three effects (teacher, teacher-curriculum, and peer-curriculum) and one emerged from peer effect. The axial codes *positive student-teacher relationship* and *behavioral expectations* emerged from teacher effect. The students described the teacher as “nice” and “helpful.” This indicated that the students believed that the teacher cared about them and their success. This belief seemed to motivate the students to engage with the mathematics and work towards their own success. The axial code *behavioral expectations* emerged from the students change in participation practices. I found students latently disrespectful in initial observations, but as they demonstrated a growing relationship with the teacher in their interactions, they began to participate more appropriately. In interviews and in student actions, I found students seeking help from the teacher and paraprofessional. Students often turned to the teacher for support offering additional evidence of the relationship they were building with the teacher.

As students demonstrated a growing ease with the teacher and began to engage more with the mathematics, they illustrated a growing self-efficacy. In pre-implementation interviews, they often described their ability as “not good” or “bad.” The teacher, however, worked to help them build a belief in their own ability to answer questions in class and to work problems in front of the class. Over time, they described their perceived ability “as good as” or “better than” their peers.

The axial codes *pace and content* and *challenges of absenteeism* related to teacher-curriculum effect. Students stated that the adjusted curriculum enabled them to understand mathematics. They also recognized that the tasks and activities the teacher
enacted helped them engage with the mathematics and practice the content. Students also understood that the pace and content of the class was slower and on a more basic level, but they perceived that this helped them better understand the mathematics. I found they demonstrated their understanding of the academic expectations as they worked more with the content in tasks and activities and noted the benefit of their participation. They showed an increase of cognitive engagement as they set higher academic goals of earning A’s for third and fourth terms, graduating from high school, and graduating from college. Several of the students also stated they gained a greater confidence in this class, which they stated made them want to engage more with the mathematics in the class.

Ms. Green and two of the students mentioned the challenges of absenteeism included missing content prepared by the teacher. I found that when students missed class often, their motivation to engage waned and they felt discouraged as they found themselves not understanding the content.

The axial codes peer perception and peer responsibility related to peer-curriculum effect. I was surprised to find that although peers in middle school often have a great influence on students’ self-concept, these students were not dissuaded from attending this ESC when comparing the level of the ESC to classes their peers attended. While they recognized the ESC taught fewer concepts at a slower pace, these students perceived their placement in the ESC as an opportunity to receive the help they needed. Also surprising was the finding that their perception of their responsibility in the class changed over time. The number of their positive engagements increased and the number of their negative engagements decreased. They also exhibited a growth in mathematics self-efficacy as
they took on an active role to help lead the class and to help other students who struggled with the mathematics.

Peer effect related to only one main axial code of *peer influence*. I found students demonstrated social behaviors directly tied to the prosocial and dissocial interactions with their peers in the class although they denied the influence of their peers on their social and academic behaviors. I found the students expressed this influence in terms of wanting to gain acceptance, the students’ behaviors mimicked those of their peers. Peers also motivated and encouraged positive and negative behaviors. I found the self-efficacy and engagement indicators related to peer effect and mostly reflected emotional and social aspects of the class. Students expressed a desire for belongingness wanting to “fit in” with the social structure of the class.

In the following section, I will show how the quantitative data aligned with the study and the four effects: teacher, teacher-curriculum, peer-curriculum, and peer. I gathered these data from the pre- and post-implementation surveys of these same students.

**Quantitative Data Analyses**

Analyses from the data from student pre- and post-implementation surveys provided another means by which to measure students’ perceptions of their self-efficacy and engagement. I used descriptive and inferential statistics to analyze the data from pre- and post-implementation surveys and report the findings below.

The 46-item Student Self-Efficacy and Engagement Survey was divided into five categories. These categories indicated the self-reported self-efficacy beliefs and the four
engagement types (cognitive, behavioral, emotional, and social). The scores were then summed for each of the five categories for both the pre-implementation survey and the post-implementation survey per the instructions for the measurement tool as outlined in the data sources and instruments section. These totals serve as the dependent variables to run the following analyses. The null hypothesis was that aligning teacher quality, peer support, and appropriate curriculum for students SBGL in mathematics would have no effect on students’ self-efficacy beliefs and engagement in mathematics.

Comparison Plot of Pre- and Post-Implementation Data

Figure 8 shows the results of the pre- and post-implementation surveys in box plot form. Each of the variables has a box representing the pre-implementation results (the light grey boxes) and the post-implementation results (the dark grey boxes) starting with self-efficacy, then cognitive engagement, behavioral engagement, emotional engagement, and then social engagement.

As illustrated in figure 8, all areas but emotional engagement show a visible increase in self-reported self-efficacy and engagement. The first three quartiles including the minimum values increased for all variables in the study. Aside from the small decrease in the maximums for emotional engagement and the maximum outlier of behavioral engagement, all maximum values also increased. While the maximum for the emotional engagement box plot decreased, the median score increased and the data were less spread. This reflects a lower standard deviation and more uniform results throughout the class.
Analysis of Group of Selected Students Subsample

These data from the class as a whole lead to the more specific analyses of the quantitative data. Because I gathered qualitative data focused mainly on five selected students throughout the study, I wanted to compare the pre- and post-implementation survey results of the group of five students \((n = 5)\) with the rest of the students in the class \((n = 14)\). The means and standard deviation results appear in Table 7 for the group of five and the class as a whole as well as the totals for both the pre- and post-implementation surveys.

Figure 6. Box plots showing pre- and post-survey data. The light grey boxes indicate pre-implementation survey results in each category. The dark grey boxes indicate post-implementation survey results in each category. \((n = 19)\)
Table 7

Pre and Post Results for Group and Class: Summary of Five Measures on the Pre and Post Surveys for Five Students and for the Class as a Whole

<table>
<thead>
<tr>
<th>Measure</th>
<th>Phase I: Pre-implementation</th>
<th>Phase III: Post-implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group (n = 5)</td>
<td>Class (n = 14)</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Self-efficacy Possible: 65</td>
<td>26.08</td>
<td>12.60</td>
</tr>
<tr>
<td>Behavioral engagement Possible: 40</td>
<td>22.10</td>
<td>5.33</td>
</tr>
<tr>
<td>Emotional engagement Possible: 50</td>
<td>25.76</td>
<td>10.76</td>
</tr>
<tr>
<td>Social engagement Possible: 40</td>
<td>21.73</td>
<td>11.90</td>
</tr>
</tbody>
</table>

*Note: Beside each name is the total number of points possible for that measure.*

Four of the five selected students had enrolled in the class within two class periods of the start of the study. As I had anticipated, the results in Table 7 show the five students collectively had lower means for self-efficacy and all engagement categories than the other students in the class, many of whom had enrolled during the first term of the school year. When running five separate 2x2 mixed design ANOVA models, one for each domain (between-groups = 2-level group-class factor, within-subjects was time), all findings showed that the gains were not differential for the five students who were selected for the in-depth interviews, $p = .06-.89$. I did not find the differences between the group of five, the others in the class and the class as a whole to be mathematically significant. These data allowed me to use the group of five students to represent the class
as a whole when analyzing changes during the study. I included these group details in Appendix M.

Two important observations of the data include the changes in the means between the groups for emotional engagement and social engagement. The increase in these two domains for the group of five students surpassed the growth of the rest of the class for a resultant higher mean at the end of the study. These two categories were the only domains to show quantitative results that diverged from the qualitative results. Quantitative results showed the class as a whole did not have a significant increase in these domains.

**Considering Student Sex in the Data Analysis**

After considering the differences and similarities of the data by group, I considered the potential effect the study could have on students based on sex. Because of past research indicating that female students often have lower self-efficacy in mathematics (Deutsch, 2017; Udoaka, 2017), I wondered if students in this ESC would have different results in self-efficacy and in the engagement categories based on sex. Table 8 shows the pre- and post-implementation results for the students based on sex. The table lists the pre-implementation survey results for each domain for females taking the survey, for males taking the survey, and for the class collectively. For self-efficacy, females scored higher than males in the pre-implementation survey. In the post-implementation survey, females scored lower than they did on their pre-implementation survey while males scored 11.60 points higher. Females also scored lower on post-implementation survey items for social engagement than on their pre-implementation
Table 8

Pre and Post Survey Results by Sex. Summary of Five Measures at Two Phases, by Student Sex

<table>
<thead>
<tr>
<th>Measure</th>
<th>Phase I: Pre-implementation</th>
<th>Phase III: Post-implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female ($n = 6$)</td>
<td>Male ($n = 13$)</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>41.35 17.47</td>
<td>33.00 10.26</td>
</tr>
<tr>
<td>Cognitive engagement</td>
<td>22.44 4.33</td>
<td>16.74 6.05</td>
</tr>
<tr>
<td>Behavioral engagement</td>
<td>29.04 6.33</td>
<td>21.44 5.24</td>
</tr>
<tr>
<td>Emotional engagement</td>
<td>37.28 4.95</td>
<td>23.05 9.26</td>
</tr>
<tr>
<td>Social engagement</td>
<td>31.39 74.02</td>
<td>20.58 7.86</td>
</tr>
</tbody>
</table>

survey items. Males, however, scored higher on their post-implementation scores for all domains. From these results, one could suggest a need for further research on how this ESC relates to the domains based on sex. However, the five separate 2x2 mixed design ANOVAs, one for each domain (between-groups = 2-level sex factor, within-subjects was time), showed that the gains were not differential by student sex, $p = .08-.45$.

While these data provide interesting information about the pre- and post-implementation survey scores for females and males, changes in these data proved to be statistically insignificant. The statistical results for self-efficacy are $F(1, 17) = 3.38, p = .08$, partial $\eta^2 = .17$. The statistical results for cognitive engagement are $F(1, 17) = .90, p = .43$, partial $\eta^2 = .15$. The statistical results for behavioral engagement are $F(1, 17) = .95, p = .34$, partial $\eta^2 = .15$. The statistical results for emotional engagement are $F(1, 17) = .58, p = .46$, partial $\eta^2 = .11$. The statistical results for social engagement are $F(1, 17) =$. 
2.21, \( p = .16 \), partial \( \eta^2 = .29 \). Considering that these data lay outside the scope of the study, I only included these details in Appendix M.

**Correlation Among the Five Domains**

Pearson product-moment correlation coefficients quantify the degree of association between measures and allow for study of the relationship between self-efficacy and engagement indicators. The null hypothesis states that there is no relationship between self-efficacy and the four engagement indicators for students SBGL in mathematics attending an ESC. The correlation results appear in Table 9.

Table 9 illustrates that all of the domains measured at pre-implementation correlated with each other. The diagonal represents the pre-implementation results for each of the domains correlated to the post-implementation results of the same domain. Above the diagonal, the pre-implementation data for each of the domains correlated to

Table 9

*Correlation Matrix for Five Domains. Relationship Among the Five Domains, Within Pre-Implementation Survey (Upper Right) and Between Pre- and Post-Implementation Surveys (Lower Left)*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Self-efficacy</th>
<th>Cognitive engagement</th>
<th>Behavioral engagement</th>
<th>Emotional engagement</th>
<th>Social engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>.54*</td>
<td>.59**</td>
<td>.54*</td>
<td>.57*</td>
<td>.57*</td>
</tr>
<tr>
<td>Cognitive engagement</td>
<td>.22</td>
<td>.27</td>
<td>.59**</td>
<td>.77**</td>
<td>.77**</td>
</tr>
<tr>
<td>Behavioral engagement</td>
<td>.10</td>
<td>.26</td>
<td>.38</td>
<td>.81**</td>
<td>.79**</td>
</tr>
<tr>
<td>Emotional engagement</td>
<td>.05</td>
<td>.23</td>
<td>.20</td>
<td>.36</td>
<td>.84**</td>
</tr>
<tr>
<td>Social engagement</td>
<td>.02</td>
<td>.38</td>
<td>.46*</td>
<td>.56*</td>
<td>.46*</td>
</tr>
</tbody>
</table>

*Note: Data in the top right of the chart correlates the pre-implementation results to the pre-implementation results. Correlation data in the lower left of the chart correlates the pre-implementation results to the post-implementation results.*

* \( p < .05 \).

** \( p < .01 \).
the other domains. For example, there is a correlation coefficient of .59 between how self-efficacy correlated with cognitive engagement in the pre-implementation survey. All of these pre-implementation results contain moderate to large values of Pearson’s correlation coefficients ($r = .54-.84$) and all of the correlations are statistically significant ($p < .05$ indicated with *).

Below the diagonal, the domains are cross-correlated between the post-implementation scores. These data reveal little to no association between measures across time and showed significance in only three relationships.

The fact that all of the relationships were significant was interesting for three reasons. First, the only two domains that showed a correlation between the pre-and post-implementation data were for self-efficacy and social engagement. It appears that the students SBGL in mathematics who participated in the study tied their perceived self-efficacy with each of the engagement types. Furthermore, the engagement types also relate to each other. Students seem to tie their perceived inability to their non-engagement in the class and this inability correlates between and within each of the engagement types.

Second, most of these relationships were no longer significant in the post-implementation correlation data. The data indicate that as students SBGL in mathematics increase in their perceived ability, there is a lesser correlation between the domains although the correlations are still positive. In this regard, self-efficacy dropped to having low to almost no correlation with all of the engagement domains. Students SBGL in mathematics do not appear to self-report a significant association between these domains as they increase their perceived ability.
Third, the two correlations that still showed significance in between the domains for the post-implementation data were between the behavioral engagement and social engagement and emotional engagement and social engagement. This third point is particularly interesting in that the quantitative data show that emotional and social engagement changes in the self-reported quantitative data were not significant (as described below), but the social engagement correlations were significant with these two other engagement types. In that the analysis of these correlations and their changes lie outside of the scope of the study, I did not pursue these analyses in this study.

**Gains in the Five Domains**

Next, to evaluate whether a statistically significant difference existed between the mean of each domain (self-efficacy, cognitive engagement, behavioral engagement, emotional engagement, and social engagement) before and after students had participated in the ESC for 4 months, I ran paired-sample *t* tests. The means and standard deviations for these tests appear in the column denoted “total” in Tables 7 and 8. The results of the paired sample *t* tests are listed in Table 10.

A significant increase in the domains of self-efficacy, *t*(18) = 2.51, *p* = .02, *d* = .56; cognitive engagement, *t*(18) = 2.13, *p* = .05, *d* = .60; and behavioral engagement, *t*(18) = 2.64, *p* = .02, *d* = .68. Emotional engagement, *t*(18) = .73, *p* = .47, *d* = .19; and social engagement, *t*(18) = 1.61, *p* = .13, *d* = .39; did not show significant increases over the course of the study.

These data indicate that the students SBGL in mathematics in this study perceived that they increased in mathematics ability by enrolling and participating in this ESC.
Table 10

Results of Five Separate Paired Samples t Tests

<table>
<thead>
<tr>
<th>Measure</th>
<th>Phase I: Pre-implementation</th>
<th>Phase III: Post-implementation</th>
<th>Mean gain score</th>
<th>t(18)</th>
<th>Sig.</th>
<th>ES, $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>35.64</td>
<td>43.64</td>
<td>7.90</td>
<td>2.51</td>
<td>.02†</td>
<td>.26</td>
</tr>
<tr>
<td>Cognitive engagement</td>
<td>18.54</td>
<td>21.66</td>
<td>3.12</td>
<td>2.13</td>
<td>.05†</td>
<td>.20</td>
</tr>
<tr>
<td>Behavioral engagement</td>
<td>23.84</td>
<td>27.78</td>
<td>3.94</td>
<td>2.64</td>
<td>.02†</td>
<td>.28</td>
</tr>
<tr>
<td>Emotional engagement</td>
<td>27.55</td>
<td>29.36</td>
<td>1.81</td>
<td>-.73</td>
<td>.47</td>
<td>.03</td>
</tr>
<tr>
<td>Social engagement</td>
<td>23.99</td>
<td>26.96</td>
<td>3.00</td>
<td>1.60</td>
<td>.13</td>
<td>.12</td>
</tr>
</tbody>
</table>

$n = 19.$

† indicates significance at $\alpha < .05$

They self-reported an increase in how they interact with and understand the mathematics. They also self-reported gains in positive behavioral engagement in the class. However, they did not recognize a change in their feelings about mathematics or attending mathematics class. This may result from a positive experience with the mathematics in this class but may not substantially change their feelings of frustration or inadequacy about mathematics in general.

They do not recognize a change in their social engagement with others regarding mathematics. Students SBGL in mathematics may have social engagement changes in the ESC but may not recognize the social influence of or upon others in their mathematics community.

Even though the change in emotional and social engagement was not statistically significant, these results did show an increase in the mean scores. These smaller increases suggest students may not recognize and self-report these engagement type changes. These
smaller increases could also suggest that emotional and social change was not as significant as other changes. This, however, seems unlikely in light of the qualitative results, which I will address in the mixed methods section below. It may also suggest students do not perceive emotional or social changes well in ninth grade. Additional time in the study may have revealed a greater change in both areas.

Since all five domains were measured on all subjects, I conducted further analysis via Repeated Measures ANOVA. I attempted to leverage the correlations established in Table 9 to see if the gain in statistical power could establish significance in all domains.

In addition to the five separate paired t tests, the gains between pre- and post-implementation for the five domains (self-efficacy and the four engagement types) were subjected to a 2x5 Repeated Measures ANOVA to simultaneously analyze all the scores together. Mauchly’s Test revealed that the assumption of sphericity (meaning the variances between the differences in all possible pairs are not roughly the same) was violated for both the main effect of domain and interaction between domain and time. Thus, the results in Table 11 include both the significance with and without the application of the appropriate Greenhouse-Geisser epsilon correction to the degrees of freedom. Although the interaction’s significance does not strictly fall below the traditional cut-off of five percent, $F(1, 17) = 3.00, p = .06, \eta^2 = .14$, there is evidence that the gains are not consistent across all domains. This is consistent with the tests indicating students’ self-reported emotional and social engagement did not change significantly.

The data also show that the interactions between the domains differed over the
Table 11  

*Correction Results of Pre and Post Data and Domain Interactions. Interactions Between Domains 2x5 Repeated Measures ANOVA Model*  

<table>
<thead>
<tr>
<th>Interaction</th>
<th>df</th>
<th>F</th>
<th>Greenhouse-Geisser, ε</th>
<th>Sphericity assumed</th>
<th>Greenhouse-Geisser</th>
<th>Partial η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre vs. post</td>
<td>1, 18</td>
<td>4.74</td>
<td>-</td>
<td>.0430</td>
<td>-</td>
<td>.21</td>
</tr>
<tr>
<td>Domain</td>
<td>4, 72</td>
<td>28.50</td>
<td>.38</td>
<td>&lt; .01</td>
<td>&lt; .01</td>
<td>.61</td>
</tr>
<tr>
<td>Interaction</td>
<td>4, 72</td>
<td>3.00</td>
<td>.53</td>
<td>.03</td>
<td>.06</td>
<td>.14</td>
</tr>
</tbody>
</table>

The course of the study. This may indicate that students’ reactions and attitudes about the mathematics, their ability, and emotional and social interactions changed as students perceived their ability increased. Because the number of students in the study was very small, the adjustments listed below may indicate that larger numbers may reveal significance across all domains.

Figure 9 shows the results of the 2x5 Repeated Measures ANOVA illustrating time and domain. This figure illustrates an increase in each of the domains although the increases in emotional and social engagement were not statistically significant. This also illustrates the students’ perceptions of their cognitive engagement with the mathematics.

Figure 9 illustrates the differential increases in scores dependent on domain. The follow-up ANOVA tests reach the same conclusions as the matched pairs *t* tests tabulated in Table 10, such that there were significant gains in self-efficacy ($M_{\text{diff}} = 7.90, p = .02$), cognitive ($M_{\text{diff}} = 3.1, p = .05$), and behavioral ($M_{\text{diff}} = 73.94, p = .02$) further confirming the *t* test data. No evidence of gain was established for neither emotional ($p = .47$), nor social engagement ($p = .13$).
Figure 7. Repeated measures ANOVA simultaneously models time and domain. The domains appear from top to bottom as self-efficacy, emotional engagement, behavioral engagement, social engagement, and cognitive engagement.

Figure 9 illustrates the increase in all domains, especially significant in the self-efficacy domain. While the self-efficacy looks as though the students began with a higher ranking of self-efficacy, there were a possible 65 points allowable while other areas had as few as 35. Regardless of the points possible initially, the slope of the self-efficacy line indicates the greatest change of all the domains. While cognitive engagement had the lowest number of possible points of 35, this was only 5 points fewer than behavioral engagement and social engagement, both of which students self-reported much higher.
initially. This would indicate the students had the lowest opinion of their cognitive engagement of all of the domains analyzed. Figure 9 also indicates students’ increases in all of the domains very similarly as the lines increase at similar rates. Emotional engagement increases at the lowest rate of change. The line representing the change in social engagement, which did not reveal a significant change, indicates a slope almost parallel to the line representing cognitive engagement. Cognitive engagement, however, did show a statistically significant change where social engagement did not. The mean score for cognitive engagement pre-implementation results, however, was comparatively very low. This resulted in a smaller change in the mean to create significance in the pre-to post-implementation change.

**Summary of Quantitative Analysis**

In summary, the box plots of the data comparing the pre- and post-implementation results of the survey show how there is an increase in every variable of the study to varying degrees. Comparing the group of students selected for interviews and comparing female and male results yielded no significant differences for the gains between pre- and post-implementation surveys. The paired-samples $t$ tests indicated that there was a statistically significant change in self-efficacy, cognitive engagement, and behavioral engagement for the students in the class as a whole, but not for emotional or social engagement. This suggests that participating in the ESC increased self-efficacy, cognitive engagement, and behavioral engagement for the students in this study and allows me to reject the null hypothesis as it applies to those variables.
Mixed Methods Analyses

This section discusses the meta-inferences derived from the quantitative and qualitative results to address how meeting the needs of students SBGL in mathematics by addressing teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect may improve students’ self-efficacy beliefs and engagement behaviors. Tashakkori and Teddlie (2010) define meta-inferences as “an overall conclusion, explanation, or understanding developed through an integration of the inferences obtained from the qualitative and quantitative strands of mixed methods study” (p. 101). I found four main meta-inferences in this study and will discuss these meta-inferences as follows:

- The relationship between the teaching effects, the learning domains, and the survey items.
- The survey items that most contributed to the convergent results regarding self-efficacy, cognitive engagement, and behavioral engagement.
- The two survey items that may have created the divergent results for emotional engagement.
- The collective survey items and how they resulted in divergent results for social engagement.

The concept of self-efficacy and engagement in adolescence can be very complex. The convergent mixed methods design of this study allowed the researcher to consider more complex explanations from the inferred and evidentiary changes in the students’ perceived self-efficacy and engagement domains.

Table 12 depicts how the data sources provided convergent and divergent results in their analyses. The four data sources included teacher pre- and post-implementation interviews from Phases I and III, four sets of student interviews with five students.
Table 12

*Sources Illustrating a Positive Change in Self-Efficacy and Engagement*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Teacher interviews</th>
<th>Student interviews</th>
<th>Observations</th>
<th>Surveys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cognitive engagement</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Behavioral engagement</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Emotional engagement</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Social engagement</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note:* Check marks indicate the domains where qualitative data from interviews and observations and quantitative data from student surveys showed notable or statistically significant change.

throughout the three phases, classroom observations in Phase II, and pre- and post-implementation surveys of the whole class.

Table 12 shows the convergence of the results where the quantitative results from the surveys supports the results from qualitative data sources. The checkmarks show where both qualitative and quantitative data supported the perceived changes in each of the domains. Absence of a checkmark indicates a divergence in the results.

I will address these relationships to the effects, the codes, and the data in the following sections. This mixed methods section addresses these results in two sections: (a) the convergent results (indicated by a checkmark in Table 12), and (b) the divergent results (indicated by the absence of a checkmark in Table 12).

**Convergent Results**

In an attempt to summarize how the qualitative data revealed noticeable change in three of the domains but not in emotional and social engagement, the researcher created Figure 10. Figure 10 illustrates the relationships among the self-efficacy and engagement
domains and the teaching effects implemented in the study.

I recognized these relationships in the following manner. The red line illustrates the relationship between self-efficacy and the domains of teacher effect and teacher-curriculum effect. The purple dotted line illustrates the relationship between cognitive engagement and teacher effect, teacher-curriculum effect and peer-curriculum effect. The solid blue line indicates the relationship of behavioral engagement to all of the effects with their accompanying axial codes.

From the analysis of Figure 10, I noticed the overlap of the qualitative results occurred in effects and codes that aligned with the quantitative survey results. These led to the meta-inferences connecting the convergent results. I will address these meta-inferences in the sections below.

Mixing these qualitative and quantitative results allowed me to conclude that aligning teacher quality, peer support, and appropriate curriculum affected the students in this study’s self-efficacy beliefs and engagement in mathematics classes. I will discuss how the qualitative and quantitative data provided information on the convergent results
of the indicators in the following order: (a) self-efficacy, (b) cognitive engagement, (c) behavioral engagement.

**Self-efficacy.** The qualitative and quantitative data showed an evidentiary change in self-efficacy over the course of the study relating to teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect. These data included the axial codes *positive student-teacher relationship, behavioral expectations, pace and content,* and *challenge of absenteeism.* The quantitative survey items that showed the greatest increase also related to these effects and axial codes. The survey items that showed the greatest increase included numbers 1, 7, and 10 (listed from greatest to least change) and they appear in Appendix J as follows, respectively.

- I believe I can do well on a mathematics test.
- I feel confident when using mathematics outside of school.
- I believe I can learn well in this mathematics course.

I have included these items in Figure 11 to illustrate the relationship among the items and the effects and axial codes.

![Figure 9. Self-efficacy survey items relate to the themes and teaching effects.](image)
Self-efficacy is the perception one has about ability or competence. Indicators that reflected students’ increase in self-efficacy included their engagement with the teacher, their peers and the curriculum. Bandura (2001) explains that self-efficacy beliefs relate to people’s perception of self and whether they have a positive or negative image of personal capability. I found students believed the teacher would support them in their efforts to succeed in mathematics, they participated more at the board, and they perceived having a responsibility to help other students. These findings related to items 1, 7, and 11 in that they reflected the students’ beliefs in the supports provided by the teacher, related to the adapted content of the ESC, and showed how the students’ perceived confidence encouraged them to help other students in the ESC. I will discuss each item in detail below.

*I believe I can do well on a mathematics test.* This item had one of the highest quantifiable changes for the items used to identify self-efficacy and echoed the axial codes *positive student-teacher relationship, behavioral expectations,* and *pace and content.* The item score increased by 1.07 out of sliding scale of five. I found students perceived they could succeed in mathematics given additional teacher help. The qualitative data show the students perceived their potential for success was in part due to help from the teacher (teacher effect) but directly related to the structure of the class and the pace and content the students were expected to learn (teacher-curriculum effect). Thus, I found that students’ self-efficacy changed positively over the course of this study indicated by their perceptions that they could do well on mathematics tests and succeed in future mathematics endeavors.
I feel confident when using mathematics outside of school. This quantitative item also had an increase of 1.07 out of a sliding scale of five. The item related to student-teacher relationship, but related more to behavioral expectations and pace and content. The teacher provided an environment and class structure that allowed the students to build confidence in their ability. The growth of their confidence was more evident in their interactions when they demonstrated their understanding of the adapted content (teacher-curriculum effect) in front of the class. This survey item indicates the students extended this confidence in their perceived ability to situations outside of the ESC when they discussed student support after extended absences. They also mentioned a dependence on teacher assistance to understand the mathematics when they returned to school.

I believe I can learn well in this mathematics course. This survey item had an increase of .96 out of a sliding scale of five. This item relates to all three axial codes positive student-teacher relationship, behavioral expectations, and pace and content. Students believed the teacher and the structure of the class would help them learn the material for the course. I found the students felt comfortable in approaching the teacher for help during and before and after class (teacher effect). They perceived the method of facilitation and the adapted curriculum in regards to pace and content would enable their achievement (teacher-curriculum effect) in the ESC. Furthermore, students perceived the activities and tasks the teacher used in her structure of the class helped the students remain engaged leading to them to believe they could succeed in this mathematics course.

This item specifically mentions “this mathematics course.” Students stated that
they were not successful in prior regular-level classes but believed they could succeed given this structure. Some also revealed some reluctance when considering future courses. This may result from their perception that the curriculum they received contained fewer concepts than the regular mathematics classes. Thus, I found that students believed this course provided them the means to learn mathematics given the specific structure of this class.

The mixing of these data provided a perspective of how and why students’ self-efficacy increased over the course of the study. In these four months, the qualitative and quantitative data merged to center on the confidence to use the mathematics the students learned in this ESC. Thus, I found this ESC structure increased students’ self-efficacy beliefs.

Cognitive engagement. Cognitive engagement refers to the goals and emotions students establish when dealing with learning. Researchers can only infer cognitive engagement from students who verbalize their thoughts, exchange ideas, and ask and answer questions making cognitive engagement challenging to identify. This form of engagement also provides fewer concrete evidences due to the overlap in the indicators of self-efficacy, cognitive engagement, and behavioral engagement (Christenson et al., 2012). Buffum and Mattos (2015) state that educators may identify low-ability students lacking the will to engage with educational content when in reality, they do not engage because they lack the skill and therefore the motivation to engage. The qualitative data showed an evident change in cognitive engagement over the course of the study relating to teacher effect, teacher-curriculum effect, and peer-curriculum effect. The quantitative
survey items that showed the greatest increase also related to these effects and axial codes. Survey items 17, 15, and 16 showed the greatest increase (listed from greatest to least change) and they appear in Appendix J as follows respectively:

- When work is hard, I only study the easy parts. (reversed)
- I try to understand my mistakes when I get something wrong.
- I would rather be told the answer than have to do the work

I have included these items in Figure 12 to illustrate the relationship among the items and the effects and axial codes.

Figure 10. Cognitive engagement survey items relate to the themes and teaching effects.
Figure 12 shows how the top survey items about cognitive engagement relate to teacher effect, teacher-curriculum effect, and peer-curriculum effect. In student interviews, I found the students expressed the desire to succeed in mathematics but they “just needed a little help.” They often stated that they found this help from the teacher as the more knowledgeable other (teacher effect). Students consistently stated they could succeed in this class because they could “understand the math” and they “finally get it.” Because of the qualitative results, I anticipated a positive change in the quantitative items relating to students’ cognitive engagement. I did not anticipate the highest increase would occur in items that reflect a desire to work for understanding. I believe this links to the students’ recognition that this curriculum was appropriate for their level of understanding (teacher-curriculum effect). I will discuss each item in detail and show how the qualitative data illustrated this desire below.

*When work is hard, I only study the easy parts (reversed).* This item had the highest quantifiable change of 1.06 out of sliding scale of five for the items used to identify cognitive engagement. The item was “reverse” indicating that that “When work is hard, I do NOT only study the easy parts.” I found this item related to teacher effect and teacher-curriculum effect. The students understood their academic deficiencies and stated that, although the class was supposed to be “easier,” their academic behaviors would have to include hard work and participation.

Before the study, I anticipated many of the students would have discarded the hope of becoming mathematically proficient after years of performing years below grade level. These students enrolled in the ESC recognized this class structure would provide
help to “fill the gaps.” Ms. Green commented, “They’re hard-working kids that have struggle (sic), but there are so many gaps and so many different areas that they don’t understand.” This indicates the teacher and the students understood the large scope of the task to learn the ninth-grade content in addition to filling the gaps from prior years. The students perceived the challenge of understanding the material and incorporated their teacher’s academic expectations (teacher effect).

In order to cover such a vast amount of material, the teacher adapted the pace and content to meet their needs (teacher-curriculum effect). When they demonstrated that they understood the material, they exhibited an increase in their engagement even when they perceived concepts to be harder. They then assumed the responsibility to help their peers also “fill the gaps.” Thus, these students recognized their deficient learning, but through their hard work increased in their cognitive engagement with the mathematics.

**I try to understand my mistakes when I get something wrong.** This item showed an increase of .63 in a sliding scale of five. This question also related to the axial codes behavioral expectations and pace and content.

As in the quantitative item above, this item indicated the students’ intent to work to understand the material. They looked to the teacher to provide the structure of the ESC and a manageable content so they could succeed. Marco also mentioned that he felt the responsibility to work at the board because he could help his peers in the class learn the content. He explained, “if [students] do it wrong, I think it’s, like, better ‘cause it shows the mistakes and, like, oh, we don’t do that so we won’t do that again and it shows me how to do the problem.” Lacey added,
So if you get [an answer] wrong and [the teachers] check it off (sic), but they can just tell you what you did wrong and you can just go and get that mistake and see what you did wrong and then see go on to the next problem and if you get it wrong again, you can just keep trying until you get it right.

These students recognized the value of mistakes and how mistakes provided learning opportunities. They indicated they did not fear making errors in front of their peers but viewed them as an opportunity to better understand the mathematics. Thus, this item indicates the students’ intent to learn from their mistakes to understand the mathematics better.

**I would rather be told the answer than have to do the work. (reversed)** This item also had a change of .63 on a sliding scale of five. This question related to the responsibility students developed towards their peers in their understanding of the mathematics. Because the item is reversed, the increase showed the students would rather do the work to understand the answer than to just be told. With the work ethic as expressed above, the students did not shrink from the challenge of making up years of mathematics. Rather, they worked hard to learn the concepts. I found that, after learning the concepts, the students then developed a sense of responsibility to help their peers learn the content (peer-curriculum effect). Furthermore, when they helped their peers, they did not simply give the answers to a problem; they explained the work and expected the student understand the work to understand the material.

**Behavioral engagement.** The qualitative data showed a change in behavioral engagement relating to all four teaching effects (teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect). The quantitative survey items that showed the greatest increase also related to these effects. The survey items that showed the greatest
increase included numbers 27, 21, and 25 (listed from greatest to least change) and they appear in Appendix J as follows respectively:

- I talk about math outside of math class.
- I stay focused in math class
- I do other things when I am supposed to be paying attention. (reversed)

I have included these items in Figure 13 to illustrate the relationship among the items and the effects and axial codes.

Kennedy (2009) defines behavioral engagement as the “level of participation or involvement that a child invests in a given activity” (pg. 2). Because an observer cannot divine the intent of the participation, I depended on the interviews and self-reported

![Diagram](image)

*Figure 11. Behavioral engagement survey items relate to the themes and teaching effects.*
surveys to analyze the observed changes in behavioral engagement. I will discuss each of
the above items in relation to the effects and axial codes below.

**I talk about math outside of class.** This survey item showed the greatest increase
for the items used to quantify behavioral engagement with a change of 1.52 on a sliding
scale of 5. I found this quantitative item related most to the axial codes peer perceptions,
and responsibility. I found the social aspect of this item reflecting how students stated
that they talked to their peers about the differences in the curriculum and classes and how
they tried to help students even outside of the ESC. If students had indicated their
reticence to discuss these differences, it would possibly reflect that they were ashamed of
their ability or their enrollment in the class. However, they often stated that their
enrollment was to help them “fill the gaps” in their understanding or “tried to help” other
students with their homework.

For example, Hayden discussed how he tried to help other students outside of
class. He stated, “Some of my other friends that are in different classes ask me for help
on a problem on their homework.” He then explained that he had difficulty helping them
because of the difference in content. Marco talked about how “some of [his] friends
helped [him] learn the material” outside of class because he did not understand after his
extended absences. Thus, this item indicated not only that students thought about
mathematics outside of class, but they tried to help their each other as well.

**I stay focused in math class.** This item showed a change of 1.24 on a sliding scale
of five. I found this item related most to the axial codes responsibility and peer influence
in the effects of peer-curriculum effect and peer effect respectively.
As students perceived that they understood the mathematics better, they grew more willing to engage with the class in working at the board and helping each other with their homework. Engagement through tasks and activities increased as students focused on the mathematics they were learning. Additionally, when they exhibited an understanding of the content, they more quickly engaged with the tasks and completed assignments that helped them realize their short-term goals of earning better grades.

I found the ESC as a whole focused more on the content as the study progressed and they followed directions and expectations more readily as they seemed to become more proficient with the mathematics. Ms. Green noted in her post-implementation interview that this was a practice she tried to teach in her class. She stated, “The ability to focus and stay on task is something that is expected and something we cater to to (sic) kind of help those kids.”

I do other things when I am supposed to be paying attention. (reversed) This reversed item showed an increase of .75 meaning that students perceived they were less distracted when they were supposed to be paying attention. In my observations, I found students became more centered on appropriate activities over the course of the study. This resulted from greater participation in class discussions, greater compliance with instructions, and a growing sense community as they helped each other complete assignments. After viewing the video from the first observation set, Hayden stated, “I think that I could do better and so I’m gonna try harder.” In this way, this item relates most to the axial codes of responsibility for their learning and the learning of others (peer-curriculum effect) and peer influence (peer effect).
Divergent Results

Through my qualitative analyses, I found an increase in self-efficacy beliefs and the four categories of engagement. The quantitative results also showed an increase in the means of all of these variables; the mean increases, however, were not statistically significant for (a) emotional engagement, and (b) social engagement. The student interviews in particular revealed improvement in these areas, but self-reporting of emotions and peer interactions in the 46-question survey did not show a significant change.

**Emotional engagement.** The participants in the teacher and student interviews as well as the memos from the observations describe a change in attitude and atmosphere in the class. Researchers identify emotional engagement by considering affective responses to learning activities. Students’ perceptions of their own competence may enhance emotional engagement (Fredricks et al., 2004). These students exhibited a qualitative change in emotional engagement over the course of the study. In student interviews, students expressed relief, hope, and pride to be in the class learning the mathematics. In my observations, students participated more and excitedly discussed the mathematics in class. While the items in the quantitative survey did not reveal a significant increase, further analysis may explain why.

The survey results showed an increase in the mean for emotional engagement of only 1.81 (on a sliding scale of 5) or of 36.20% from the pre- to the post-implementation scores. The collective change for all the emotional engagement items was .47, or non-statistically significant with a $p > .05$. Examination of the survey items showed the emotional engagement questions had widely conflicting results. For example, item #29
(“I want to understand what is taught in math class.”) had an increase of .67 indicating a change that students did want to understand the mathematics. Item #24 (“I don’t want to be in math class—reversed”) had a decrease of –1.04 indicating that students increasingly did not want to be in mathematics class. Both items dealt with attending the mathematics class with drastically different results.

Based on observations and interviews, I would infer that students wanted to understand the mathematics, but in this short four months, may recognize the work required to understand the material and still not enjoy the subject of mathematics. During the timeframe of the study, the students had developed a more positive outlook about learning the mathematics, but a positive learning experience may not negate the stigma and opinions they had developed about mathematics.

I chose these items for this study to analyze the emotional engagement students had with mathematics in the ESC. The developers of these engagement items intended to determine the levels of emotional engagement and reported a Cronbach’s Alpha of .89 for these items. The analysis showed an increase in emotional engagement for eight of the items ranging from .12 to 1.42. The other two items not showing an increase were reversed items #37 and #38 (“I don’t want to be in math class,” and “I often feel down when I am in math class.”) These two items had a score of –1.04 and –1.14, respectively. The decrease indicated that these students did not want to be in mathematics class and they felt down when they were in mathematics class. Because of the nature of middle school students’ interests and social development, students very likely would want to be somewhere other than mathematics class or even school in general. Likewise, they may
“feel down” in all their classes depending on what other events affect their lives. In her post-implementation interview, Ms. Green stated, “I also think that there are so many things that we don’t see and understand. What’s happening at home? What’s happened in their background?” When students scored these two survey items, they may have related them to other events outside of the ESC affecting their emotions associated with the ESC.

Also, this survey was administered in February in the middle of term three, halfway through their enrollment in ESC. As noted above in the convergent section, the students understood they had gaps to fill as well as grade-level concepts to master. They were in the middle of a challenging goal. While results showed an increase in emotional engagement in eight of the items of the survey, they may have had more optimism about any or all of the items at the onset of their enrollment about being in the class.

The sum of the positive changes in eight of the items equaled 4.84 with a mean positive change of .61. The sum of the two negative items of the survey equaled –2.18 with a mean of –1.09. These two items could explain the findings that participation in this ESC did not have a significant change in emotional engagement. Thus, while the qualitative data show an increase in emotional engagement, these two items of the survey may have had enough impact of the quantitative results to report no significant change.

**Social engagement.** Social engagement addresses how social interaction impacts learning and learners. Students who engage socially negotiate their identities with communities of practice (Hickey & Zuiker, 2005). I found observable changes in the social interactions among the students in the class and comments made during the student interviews. However, student interviews also revealed the students did not recognize the
social influences on their own learning. Furthermore, the quantitative responses of the students revealed a change of only 2.97 or 7.43% change from the pre-to the post-implementation scores.

Ms. Green corroborated the qualitative change I found in my analysis. She noted in her pre-implementation interview comments about prior years’ classes, “It’s something that we’ve seen the students grow—not only math skills, but as an individual and be able to build confidence.” In her post-implementation interview, she commented on the changes she observed about one student stating, “The kid they describe [with behavior and responsibility issues] isn’t the same kid that I have.”

Student interviews revealed conflicting results. Students interacting within the social structure of the ESC are players possibly too close to provide an objective valuation of peer effect on their mathematics engagement. The interviewed students recognized the social relationship of the teacher(s) of the ESC in promoting their motivation and access to the mathematics. They also acknowledged they wanted peer acceptance; they wanted to “fit in.” They showed they wanted to help their peers succeed in learning mathematics whether in the ESC or in other classes. They, however, disavowed the level of peer influence on their behavior or motivation in the class.

When asked which of the factors (teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect) they believed most affected their actions and motivation in class, all but one stated that peer effect was the least important. In the same interview, the students acknowledged their desire to help and support other students in the class. They expressed the belief in their responsibility to help other students who
struggle mathematically. Additionally, they all stated that they anticipated and hoped for the successes of other students who worked problems at the board showing an increase in the sense of community in the class. Because of these strong social engagement indicators, I was surprised by the non-significant results of the post-implementation survey.

Of the eight items addressing social engagement, five of them showed a minimal increase in their means of only .28 on a sliding scale of five. Three items showed a decrease in their means with an average decrease of –.25. All of the items in the survey reference developing learning and understand through interactions with others. I can only infer from my observations and from prior research why these qualitative and quantitative results diverged.

As students perceived their increased ability, they did not perceive how that increase might relate to the ESC community. Murayama, Pekrun, Lichtenfeld, and vom Hofe (2013) concluded in their study that perceived control plays a prominent role in motivation theories and learning regarding mathematics achievement. Perhaps in an attempt to retain this locus of control, students in this ESC rejected the overt influence their peers and others have on their mathematics achievement.

Thus, I would conclude the divergence of the social engagement data results from external verses internal evaluation of the data. As a more objective observer, I would conclude an evidentiary increase in social engagement. The more subjective evaluation of social engagement from the students’ perspective as player in the field of the ESC rejects the social effect on their engagement with the mathematics.
Summary

The qualitative and quantitative data indicate that there is an increase in self-efficacy beliefs and engagement indicators when meeting the needs of students SBGL in mathematics by addressing (a) teacher effect, (b) teacher-curriculum effect, (c) peer-curriculum effect, and (d) peer effect. The qualitative data indicate changes over time for students SBGL in mathematics as they participate in the class and develop better basic mathematics skills. The quantitative data analyses show a statistically significant change in students’ self-efficacy beliefs, cognitive engagement indicators, and behavioral engagement. Comparatively, the students’ emotional engagement and social engagement did not provide quantitative evidence of significant changes over the course of the study.

The meta-inferences made after considering the convergent analysis suggest students perceive their success in mathematics relates to the help they receive and their efforts expended in learning the mathematics. The meta-inferences made after considering the divergent results, where quantitative analysis of two types of engagement, emotional and social, revealed the cause of the conflicting results between the qualitative and quantitative data. The conflicting results with the emotional engagement data may have related to two of the ten items in the emotional engagement survey items. The conflicting results with the social engagement data may have related to students’ subjective perception of social influences in the class and/or the effect of students’ perception of their locus of control. Additionally, quantitative data results may have been skewed due to the small participant size ($n = 19$).
CHAPTER V
DISCUSSION

The purpose of this study was to examine how aligning teacher quality, peer support, and appropriate curriculum affected the self-efficacy beliefs and observable engagement indicators of ninth-grade students who perform substantially below grade level (SBGL) in mathematics. The researcher gathered qualitative and quantitative data over four months for this QUAL + quan convergent parallel mixed methods case study. Qualitative data came from interviews, observations, and video analysis. Quantitative data came from pre- and post-implementation student surveys. The mixed convergent and divergent findings describe the changes found in student self-efficacy and engagement.

Research Questions

The overarching question of the study was “How does addressing the needs of middle school students substantially below grade level (SBGL) in mathematics by aligning teacher quality, peer support, and appropriate curriculum affect the students’ self-efficacy beliefs and engagement in mathematics classes?” In particular, this researcher will discuss how participating students perceived and exhibited self-efficacy indicators and their engagement with the curriculum. Many of the findings of this study reflect the four sources of self-efficacy discussed in the literature review section above: (a) physiological and/or emotional states, (b) mastery experience of past performance, (c) verbal persuasion, and (d) vicarious experience.

The convergent findings showed how the indicators related to all four teaching
effects and aligned with the themes that emerged in the study: (a) student-relationships, (b) behavioral expectations, (c) pace and content, (d) challenge of absenteeism, (e) peer perceptions, (f) peer responsibility, and (g) peer influence. These themes related to the increase in self-efficacy and engagement as explained below in the following sections.

The researcher organized this discussion in five sections. In the first two sections, the researcher will discuss students’ self-efficacy and engagement indicators and changes in students’ self-efficacy and engagement. In the third section, the researcher will discuss limitations of the study. In the fourth section, the researcher will discuss implications of the study. In the fifth section, the researcher will address suggestions for future research.

**Exhibited Self-Efficacy and Engagement Indicators**

The first focus of the study considered findings that explained the self-efficacy and engagement indicators exhibited by students SBGL in mathematics and how these indicators related to the effects. The study’s convergent findings explain how multiple students exhibited self-efficacy indicators and engaged with the mathematics when interacting with the teacher, the curriculum, and their peers. The convergent findings showed how the indicators fell across all four teaching effects and aligned with the axial codes that emerged in the study.

**Student Relationships**

The student relationships align with a change in students’ self-efficacy, cognitive engagement, and behavioral engagement by creating the belief in a support system that could help them succeed in this essential standards class (ESC). This support system

was found in student-teacher relationships (teacher effect) and student-student relationships (peer effect). The researcher found student-teacher relationships were most effective when the students perceive the teacher desired and worked for student success. Students stated they felt Ms. Green was “nice” and “helpful.” Students engaged with the mathematics when the teacher interacted directly with the students by talking to them, sitting with them, kneeling by them, and circulating among them to help them with their work. Other researchers have found that these perceptions relate to self-efficacy as students recognize a support structure teachers provide to help them succeed (Landis & Reschly, 2013; Ryan & Shim, 2012). This also relates to the physiological and/or emotional states of the students as the teacher fostered genuine and positive experiences and emotions related to the mathematics class.

This researcher found that an important aspect of engagement for students SBGL in mathematics centers on teacher effect and the positive relationship developed therewith (You et al., 2016). Another way the teacher exhibited interest in their success was through her preparation of the lessons and tasks. The researcher also found that students expressed an increased interest in the mathematics and school when the tasks and activities aligned with their abilities in the ESC. This echoed the findings of Stein, Grover, and Henningsen (1996) who emphasized the impact of tasks aligned to the cognitive ability of students and the challenge of keeping those tasks at a high cognitive demand for students at a lower cognitive level. The teacher designed these activities to include movement and student-teacher and student-student interactions rather than, as Ms. Green stated, “sitting and taking notes.”
Another important student relationship was the students’ interactions with their peers (student-student relationship). Mason explained he participated more because he “fit in.” Researchers have found that peer acceptance or “belongingness” includes “affective engagement” as students define their social role within a classroom (Landis & Reschly, 2013; Ryan & Shim, 2012). Findings also indicated that when students felt they “fit in,” they explained their mathematics ability as being similar or strong than their peers (J. Fredricks et al., 2011; Frontier, 2007; Schenke et al., 2015). These students SBGL in mathematics felt “dumb” and out of place in the regular-level classes “where the smart kids go.” This structure of the ESC provided a haven among peers with like-ability where these students experienced comparative success, which, in turn, motivated them to engage cognitively and behaviorally.

Additionally, when students saw other students of similar ability succeeding in their mastery experience, they developed a belief that they could also succeed. This belief built on vicarious experience helped these students overcome feelings of failure in their prior mathematics experiences.

**Help-Seeking Behaviors**

The study found that students exhibited self-efficacy, cognitive engagement, and behavioral engagement in their help-seeking actions. Students expressed a desire for success and perceived that they could receive the help they needed in this ESC to achieve this success. The relationship students built with Ms. Green (student-teacher relationship), they believed she would help them (whether at the board or with their homework), students would “do their best” on a given task. Other research findings
include how the teacher must provide a proper classroom structure that addresses students’ needs (Charalambous et al., 2008; Duflo et al., 2011; Ryan & Shim, 2012; Schenke et al., 2015; You et al., 2016). These structures include a well-defined curriculum, classroom management, and motivating instructional practices. Many of the interviewed students mentioned they believed Ms. Green would “help” them, whether at the board or with their homework. In her post-implementation interview, Lacey stated that they key to learning mathematics is, “Practicing all the time and knowing, like, to have someone to help you.” This more knowledgeable other to provide help could be the teacher or a peer.

Teacher help, however, would have little effect if students did not perceive they could succeed at the task. Frontier (2007) notes teacher and peer relationships and school climate integral in developing emotional, cognitive, and behavioral engagement. Furthermore, Furrer and Skinner (2003) state,

Feelings of relatedness tapped by measures of school climate and quality of teacher-student relationships, as well as feelings of belonging, inclusion, acceptance, importance, and interpersonal support, have been linked to important academic outcomes, including self-efficacy, success expectations, achievement values, positive affect, effort, engagement, interest in school, task goal orientation, and school marks. (p. 149)

If students do not believe they can succeed, they may not exert the effort needed to succeed academically (Pinxten, Marsh, De Fraine, Van Den Noortgate, & Van Damme, 2014). This system of support allowed the students to seek help from a more knowledgeable other and possible achieve success. These students experienced success but also vicariously experienced the successes of their peers. This helped develop increased beliefs in their own self-efficacy in mathematics. These students SBGL in
mathematics recognized that the needed help was available, but they also engaged with
the mathematics when they recognized their curriculum fell into a range in the level of
difficulty within which they could succeed in completing the task. Thus, in this study,
findings indicated that students exhibited help-seeking behaviors when they experienced
success vicariously through their peers, found emotional support from their teacher and
peers, and mastered concepts within their ability.

**Changes in Self-Efficacy, Cognitive Engagement, and Behavioral Engagement**

The second focus of the study centered on the changes found in self-efficacy and
engagement for students SBGL in mathematics. Changes in self-efficacy and engagement
can result from self-confidence as students’ mathematics anxiety wanes (Hill et al.,
2016). Schenke (2018) reports that students’ perceptions about the quality of instruction
and support influence students’ engagement. The convergent findings showed how the
changes in self-efficacy, cognitive engagement, and behavioral engagement also fell
across all four teaching effects. Within these effect categories, the changes related to the
axial codes: (a) responsibility towards their peers, (b) academic and behavioral
expectations, and (c) the optimism of future success.

**Help-Seeking to Help-Offering**

Students’ self-efficacy, cognitive engagement, and behavioral engagement
changed when they perceived their needs would be met in a support system designed to
help them succeed. The students evidenced changes in their help-seeking pursuits when
those pursuits became help-offering actions. Instead of seeking the help they needed to succeed, they demonstrated a self-efficacy enabling them to engage with their peers academically when their peers experienced struggles.

This researcher anticipated help-seeking actions to follow the finding of Ryan and Shim (2012) who explain that students performing at a regular or high-ability level first turn to their peers for help when encountering challenges in mathematics. If they do not find satisfactory support from peers, they then turn to the teacher for help. This researcher found that students SBGL in mathematics more often turned to the teacher for help first. Developing a strong positive student-teacher relationship aligned with changes in the emotional development in their self-efficacy and engagement as described above. As time in the study passed, students exhibited a gain in self-efficacy by experiencing the verbal persuasion or positive feedback and encouragement of the teacher and then engaging with their peers. This was the opposite of the Ryan and Shim (2012) findings.

Lacey again serves as a good example of this finding. At the onset of the study, she depended heavily on the approval and support from the teacher or paraprofessional. As her self-efficacy improved, this researcher found that she interacted more, socially and academically, with her peers. Additionally, her help-seeking practices evolved into help-offering practices. When Lacey switched from seeking for help and approval from Ms. Green and the paraprofessional to actively helping her peers with their work and presenting her work in front of the class, this provided evidence of this finding.

In the post-implementation interview, the researcher asked Lacey about this change in her willingness to participate and engage during the class. Lacey explained that
she would did not want to go to the board earlier in the study because she believed she would not be able to solve the problems. She explained that in her prior mathematics classes, the teacher would call her to work at the board but she would not volunteer. She said, “I wouldn’t call. But now like I call for myself.” Her change in confidence to answer questions and present her work at the board evidenced her change in self-efficacy.

Lacey’s actions relate to studies of students demonstrating Big Fish Little Pond, Let Me Show You How Smart I Am, and Let Me Help You effects (Goldin et al., 2011; Kalaycioğlu, 2017; H. W. Marsh, 1987; Rossman, 2013). These studies illustrate how students gain self-efficacy in their abilities when grouped with peers of similar ability. Once they gain self-efficacy, they become leaders and supports for their peers in learning the class content. These changes in behavior from help-seeking to help-offering indicated a shift of students’ perceived roles and relationships in the ESC structure.

Lacey’s change also relates to students’ mathematic development after experiencing years of low self-efficacy. Tzohar-Rozen and Kramarski (2014) explain that how students choose to engage with mathematics and the classroom ties directly to changes in self-efficacy and cognitive and behavioral engagement (see also Cleary & Kitsantas, 2017; Cleary et al., 2017; Landis & Reschly, 2013). Lacey would not volunteer to work at the board until her self-efficacy improved to where she felt she could engage with the mathematics. Thus, these findings indicate that given the proper support structure, the participating students SBGL in mathematics believed they could engage with the mathematics.
Changes in Behaviors

This researcher also found that students changed their behaviors and interactions with the teacher and other students. These changes reflected a change in self-efficacy, cognitive engagement, and behavioral engagement. Researchers found that when students have positive physiological and emotional experiences in the classroom, they develop greater self-efficacy and engagement (Jones, Jones, & Vermette, 2009; Landis & Reschly, 2013). These students experienced success as they mastered problems appropriate for their ability level. When they encountered grade-level content within their ability to succeed, they perceived that they could perform as well as their peers in the ESC. The study found that when students perceived this mastery experience, they engaged more appropriately with the mathematics.

Appropriate engagement included demonstrating more respect for Ms. Green and the paraprofessional. They used tools (rulers, pencils, compasses) without disrupting the lesson or their peers in the class. They demonstrated more support for their peers working on tasks or at the board by clapping or by offering verbal encouragement. These prosocial engagement behaviors increased as the number of dissocial engagements decreased. The study found that students conformed more with teacher instructions and classroom norms after they had spent the four months in the ESC. Peers also tended to hold each other more accountable for their behaviors in the class as time passed as evidenced by student responses when their peers misbehaved or disrespected the teacher. Students would comment that the misbehavior was inappropriate and encouraged proper behavior.
**Student Achievement Goals**

A third finding was that student achievement goals changed over the course of the study. For example, at the beginning of the study, three of the students the students questioned their ability to graduate from high school. Ms. Green stated that Marco planned to drop out of high school like his brother, father, and mother. By the end of the study, Marco explained that he wanted to be the first in his family to not only graduate from high school, but to also graduate from college. Additionally, all of the students but Lincoln stated their desire to graduate from college. These higher achievement goals indicated higher self-efficacy and more student cognitive engagement (Anderman, 1994; Bandura, 1997; Friedel, Cortina, Turner, & Midgley, 2007; Madjar & Chohat, 2017; Shim & Finch, 2014). This change reflected the verbal persuasion or encouragement the students received as well as the positive emotional experiences they had with the teacher and their peers.

As mentioned above, Lincoln did not express this same desire to graduate and stated that he would drop out of high school. This was after an extended absence away from the positive influence of the teacher and his supportive peers in the ESC. This aligns with researchers who found that absenteeism directly affects self-efficacy, cognitive engagement, and behavioral engagement (McNeal, 2014; Tafelski, Hejnal, Maring, McDowell, & Rencher, 2016). This indicates that regardless of the structure set in place to meet the needs of students SBGL in mathematics, excessive absences can diminish effective effects established by the teacher and school.
Limitations

The three main limitations were (a) the small number of participants, (b) the timeframe for the study, and (c) the duration of the study. The study gathered survey results from 19 participants, 5 of whom participated in interviews and observations. In that the number of students included in the case study was small, this study may not represent a majority of ninth-grade students SBGL in mathematics. To generalize the results for larger groups, the study would have to include more participants, preferably at different grade levels.

Another limitation of the study was the timing and duration of the study. The researcher anticipated that the greatest change in students’ self-efficacy and engagement would occur within the first several weeks of the class. However, because the study began the first week of November at the beginning of term two, many of the self-efficacy and engagement changes the researcher was considering in this study may have already occurred. Additionally, a longitudinal study over four years would indicate whether would measure sustainable increases and changes through high school. This data would provide more insight as to how particular effects contribute towards students’ self-efficacy and engagement with mathematics.

Implications

The findings of this study imply that teacher, curriculum and peers affect how students SBGL engage with mathematics. These findings also imply that mathematics education research studies investigating ability grouping should consider alternative
perspectives and classroom structures. For instance, this class structure of students SBGL in mathematics increased perceived success while providing grade-level concepts. These studies, however, should continue to take teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect into consideration.

Implications of this study suggest a need for educational policy that considers the complex nature of how to best address the needs of students SBGL in mathematics. For instance, administrators should require that teachers of students SBGL in mathematics be highly qualified in facilitating the content and in managing a class of these level students. These teachers should also adapt curricula and adjust the pace of the curricula because this enactment and adjustment may be critical for low-achieving students’ future success. Educators should further take into account the influence of peers on students SBGL in mathematics, carefully assess, and place students selectively and fluidly in the class. This placement process would promote the best learning environment for each student. The placement needs to be selective to ensure that teachers are not combating behavioral (or “will”) issues when trying to instruct students with “skill” issues in mathematics. Placement should be fluid in that when a student exhibits a need for additional interventions, educators provide the help immediately rather than at a time convenient to the education system. Additionally, fluidity would apply when a student no longer required an intervention like the ESC and is moved in a timely manner to where the student would be challenged and where he or she could experience success.

**Recommendations for Future Research**

The convergent results showed important changes for these students SBGL in
mathematics. However, questions remain including how these results will affect high school mathematics engagement and whether the changes found in this study will have longitudinal effects.

Middle and high school students create an interesting set of challenges as they often mature physically, cognitively, and emotionally throughout adolescence. Li and Lerner (2013) examined the complex relationships among cognitive, emotional, and behavioral engagement as predictors of later engagement indicators in upper grades. Their findings as well as those of this study indicate that ninth grade is a pivotal period where educators can make the adjustments in engagement behaviors. Factors such as societal and parental influences affect engagement, so educators should consider how these academic interventions might allow students to foster cognitive, behavioral, emotional and social engagement. Using this class structure considering teacher effect, teacher-curriculum effect, peer-curriculum effect, and peer effect, researchers may consider the long-term outcomes of how students SBGL in mathematics engage with a community of their peers and whether this effect transcends high school and college.

Qualitative findings suggested interesting and important changes relating to emotional and social engagement although the quantitative findings were not found to be significant. Researchers should consider these divergent results in future studies as an area of focus. For instance, researching these structures with multiple perspectives in a classroom setting may provide more comprehensive interpretations around these results. Finally, it would benefit future research to determine how these engagement types may affect achievement.
Conclusion

In spite of the stagnation of national and international test scores and the decrease in adolescent engagement and motivation (Li et al., 2011), few studies consider the interplay among the relationships of self-efficacy and the four engagement types (Birgin et al., 2017; J. A. Fredricks & McColskey, 2012; J. Fredricks et al., 2011; Rossman, 2013). Additionally, researchers have overlooked the relationship of those concepts regarding teacher quality, peer support, and curriculum implementation.

This study found that students expressed greater self-efficacy in their ability to learn mathematics and engaged cognitively and behaviorally more often with mathematics tasks in the class structure of the ESC. Furthermore, it seemed the students recognized the help provided and this gave them a sense of belief and hope that they would be successful in future mathematics experiences. Qualitative data showed increased willingness to participate in class discourse, board work, and appropriate group mathematics participation. Observing that students asked more questions and were more willing to participate even when they believed their answers were incorrect. The researcher observed that when teachers addressed the mathematics needs of students who perform SBGL (i.e., adjusting curricula, developing relationships, frequently assessing, selecting enrollment appropriately) cognitive and behavioral engagement indicators and self-efficacy beliefs increase.

Changes in self-efficacy and engagement can have a positive effect on future mathematics experiences as well. While some researchers have found that placing a student in a low-ability class can have a demoralizing effect on students’ self-efficacy,
this study has illustrated the positive effects a class structure like the ESC can have. Important considerations about this class is in establishing the structure with attention to teacher effect, peer effect, teacher-curriculum effect, and peer effect as outlined in this study.
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APPENDICES
Appendix A

Institutional Review Board Approval Letter
Institutional Review Board
USU Assurance: FWA#00003308

Expedite #7

Letter of Approval

FROM:
Melanie Dornenech
Rodriguez, IRB Chair
Nicole Vouvalis, IRB Administrator

To: Beth Loveday MacDonald, Lauren Burton
Date: October 31, 2017
Protocol #: 7709
Title: A Case Study On How Meeting The Academic Needs Of Students Substantially Below Grade Level In Mathematics Affects Their Self-Efficacy Beliefs And Engagement
Risk: Minimal risk

Your proposal has been reviewed by the Institutional Review Board and is approved under expedite procedure #7 (based on the Department of Health and Human Services (DHHS) regulations for the protection of human research subjects, 45 CFR Part 46, as amended to include provisions of the Federal Policy for the Protection of Human Subjects, November 9, 1998):

Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies. This approval applies only to the proposal currently on file for the period of one year. If your study extends beyond this approval period, you must contact this office to request an annual review of this research. Any change affecting human subjects must be approved by the Board prior to implementation. Injuries or any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Institutional Review Board.

This approval applies only to the proposal currently on file for the period of one year. If your study extends beyond this approval period, you must contact this office to request an annual review of this research. Any change affecting human subjects must be approved by the Board prior to implementation. Injuries or any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Institutional Review Board.

https://mail.google.com/mail/u/1/?tab=wm#inbox/FMtcpvxzXOfgMghHNgjLtxSRumWkDDvby

8/27/2018
Pw: Approval letter from USU IRB - gyronstructor@gmail.com - Gmail
Prior to involving human subjects, properly executed informed consent must be obtained from each subject or from an authorized representative, and documentation of informed consent must be kept on file for at least three years after the project ends. Each subject must be furnished with a copy of the informed consent document for their personal records.
Appendix B

Essential Standards of Observed Lesson Topics
Table B1

Scope and Sequence Comparison of Observed Lesson Topics

<table>
<thead>
<tr>
<th>Main concept</th>
<th>Sub topics</th>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linearity</td>
<td>Tables Sequential</td>
<td>Review of 8th grade</td>
</tr>
<tr>
<td></td>
<td>Non-sequential</td>
<td></td>
</tr>
<tr>
<td>Equations</td>
<td>y = mx + b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Standard Form</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Point-Slope Form</td>
<td></td>
</tr>
<tr>
<td>Graphs</td>
<td>Positive/Negative Slopes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y-intercepts</td>
<td></td>
</tr>
<tr>
<td>Story Problems</td>
<td>Real World App</td>
<td>Apply all 4 sub topics</td>
</tr>
<tr>
<td>Parallel Lines</td>
<td>Equations</td>
<td>Slopes</td>
</tr>
<tr>
<td>Perpendicular</td>
<td>Equations</td>
<td>Slopes</td>
</tr>
<tr>
<td>Solving Equations</td>
<td>Multi-step Properties</td>
<td>Review of 8th grade</td>
</tr>
<tr>
<td>Quadratic/Cubic</td>
<td>Basic Equations</td>
<td></td>
</tr>
<tr>
<td>Literal</td>
<td>“Solve for”</td>
<td>Linear equations</td>
</tr>
<tr>
<td>Inequalities</td>
<td>Solving</td>
<td>Linear equations</td>
</tr>
<tr>
<td></td>
<td>Graphing</td>
<td>Linear equations</td>
</tr>
<tr>
<td>Systems of Linear</td>
<td>Graphing</td>
<td>Intersection as solution</td>
</tr>
<tr>
<td>Ineq.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systems of Linear</td>
<td>Number of Solutions</td>
<td>Parallel, intersecting, same equation</td>
</tr>
<tr>
<td>Eq.</td>
<td>Graphing</td>
<td>Linear equations</td>
</tr>
<tr>
<td></td>
<td>Interception as solution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equations</td>
<td>Solving Equations</td>
</tr>
<tr>
<td></td>
<td>Setting Equal</td>
<td>Solving Equations</td>
</tr>
<tr>
<td></td>
<td>Substitution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elimination</td>
<td></td>
</tr>
<tr>
<td>Features of</td>
<td>Solving using notation</td>
<td>Proper notation and meaning</td>
</tr>
<tr>
<td>Functions</td>
<td></td>
<td>Review 8th grade</td>
</tr>
<tr>
<td>Parallel Lines</td>
<td>Angles</td>
<td>Review of 8th grade</td>
</tr>
<tr>
<td></td>
<td>Names and Relationships</td>
<td></td>
</tr>
<tr>
<td>Angle Measures</td>
<td>Solving for measure</td>
<td>Systems of Equations</td>
</tr>
<tr>
<td>Parallel Equations</td>
<td>Writing Equations</td>
<td>Slopes</td>
</tr>
<tr>
<td>Constructions</td>
<td>Compass Measures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Copy Angles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parallel Lines</td>
<td>Parallel Lines</td>
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</table>

(table continues)
<table>
<thead>
<tr>
<th>Main concept</th>
<th>Sub topics</th>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations</td>
<td>Addition/Subtraction</td>
<td>Solving Equations</td>
</tr>
<tr>
<td></td>
<td>Multiplication</td>
<td></td>
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<td></td>
<td>Graphing</td>
<td></td>
</tr>
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<td>Graphs</td>
<td>Interpretation</td>
<td>Review 8th grade</td>
</tr>
<tr>
<td>Vertical Shift</td>
<td>Graphs Equations</td>
<td>Linearity</td>
</tr>
<tr>
<td>Horiz Shift</td>
<td>Graphs Equations</td>
<td>Linearity/Tables</td>
</tr>
<tr>
<td>Vertical Stretch</td>
<td>Equations</td>
<td>Slope</td>
</tr>
<tr>
<td>Sequences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arithmetic</td>
<td>Simple Interest</td>
<td>Linearity</td>
</tr>
<tr>
<td>Geometric</td>
<td>Growth/Decay Compound Interest</td>
<td></td>
</tr>
<tr>
<td>Exponential</td>
<td>Equations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Graphs Tables</td>
<td>Vertical Stretch</td>
</tr>
<tr>
<td>Transformations</td>
<td>Translations</td>
<td>Slope</td>
</tr>
<tr>
<td>Construct</td>
<td>Graphing Points</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perpendicular Lines</td>
<td>Copy Angles</td>
</tr>
<tr>
<td></td>
<td>Perpendicular Bisector</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Angle Bisector</td>
<td>Perpendicular Bis.</td>
</tr>
<tr>
<td>Reflections</td>
<td>Perpendicular Lines</td>
<td>Graph Constructions</td>
</tr>
<tr>
<td></td>
<td>Equations Linearity</td>
<td></td>
</tr>
<tr>
<td>Rotations</td>
<td>90, 180, 45 Perpendicular Bis.</td>
<td></td>
</tr>
<tr>
<td>Distance</td>
<td>Measuring Calculating Equation</td>
<td></td>
</tr>
<tr>
<td>Statistics</td>
<td>Mean/Med/Mode Calculating</td>
<td>5 Number Summary</td>
</tr>
<tr>
<td>Graphs</td>
<td>Box Dot</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Histogram Scatter Plot</td>
<td>Plot</td>
</tr>
<tr>
<td></td>
<td>Scatter Plot</td>
<td>Plot</td>
</tr>
<tr>
<td>Line of Best Fit Scatter Plots Trend Lines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correlation</td>
<td>Estimate Calculate</td>
<td></td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>Calculate</td>
<td></td>
</tr>
<tr>
<td>Frequency Tables Analyze</td>
<td>Two-way Tables</td>
<td></td>
</tr>
</tbody>
</table>

Appendix C

Secondary Math I Pre-Assessment
Secondary Math I Pre-Assessment

Simplify the following expressions

1. \(15 + 10 \div 5\)  
2. \(-5 - 10 \times 2\)  
3. \(3x + 17y - 5 + 4x\)

4. \(6y + 4(y + 2)\)  
5. \(-4x + 5 + 3x + 12y\)  
6. \(\frac{2}{3} + \frac{3}{4} \div \frac{5}{12}\)

Find slope from the following equations

7. \(y = \frac{1}{2}x + 13\)  
8. \(y + 3x = 13\)  
9. \(2y = -6x + 12\)

10. Label the variables: \(y = mx + b\)

Write the equation represented in the following story problem:

11. Bob drinks 5 cups of Mountain Dew to jump start his day and then sells 7 cups each hour he spends at his Dew stand. Write an equation that will tell how many cups he has used from his supply.

Solve the following equations for \(x\).

12. \(2x - 10 = 3x\)

13. \(-3x + 9 = 27\)

14. \(x - 5 = 2(x + 7)\)

Label & graph the following on the grid to the right.

15. Point A (1, 0)

16. Point B (-3, -2)

17. Line C: \(y = \frac{1}{2}x + 2\)

18. Line D: \(y = -3x - 1\)
Appendix D

Core Standards Comparison of the Observed Units for Essentials and Regular-Level Classes
### Table D1

**Core Standards Comparison of the Observed Units Between Classes: Comparison of the Units 4, 6, and 9 for Essentials and Regular-Level Curricula**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Essentials Class</th>
<th>Regular-level class</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Graph inequalities</td>
<td>Graph the solution set of an inequality with 2 variables</td>
</tr>
<tr>
<td></td>
<td>Graph the solution set for a given set of linear inequalities</td>
<td>Graph the system of inequalities.</td>
</tr>
<tr>
<td></td>
<td>Identify the solution set as a region on a plane</td>
<td>Write and solve system of inequalities from a story problem</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Approximate solution sets by looking at a graph</td>
</tr>
<tr>
<td>6</td>
<td>Use function notation with functions.</td>
<td>Identify the purpose of intervals using proper notation.</td>
</tr>
<tr>
<td></td>
<td>Identify a function from a graph.</td>
<td>Identify discrete, continuous, &amp; discontinuous graphs.</td>
</tr>
<tr>
<td></td>
<td>Identify continuous and discrete data</td>
<td>Identify maximum and minimum using proper notation.</td>
</tr>
<tr>
<td></td>
<td>Identify maximum and minimum</td>
<td>Identify domain and range using proper notation.</td>
</tr>
<tr>
<td></td>
<td>Identify domain and range</td>
<td>Identify increasing and decreasing intervals on a graph</td>
</tr>
<tr>
<td></td>
<td>Identify increasing and decreasing intervals using interval notation</td>
<td>Write a function from a graph, table (mapping) and story problem</td>
</tr>
<tr>
<td>9</td>
<td>Use Function Notation to write linear function equations.</td>
<td>Use Function Notation to write linear function equations.</td>
</tr>
<tr>
<td></td>
<td>Identify a function from a graph, table (mapping) and story problem.</td>
<td>Identify a function from a graph, table (mapping) and story problem.</td>
</tr>
<tr>
<td></td>
<td>Identify max and min points on a graph</td>
<td>Identifying continuous and discrete data sets Interval and notation</td>
</tr>
<tr>
<td></td>
<td>Identify domain and range on a graph</td>
<td>Identify max and min points on a graph</td>
</tr>
<tr>
<td></td>
<td>1-to-1 definition of a function</td>
<td>Identify domain and range on a graph</td>
</tr>
<tr>
<td></td>
<td>Identify increasing and decreasing intervals on a graph</td>
<td>1-to-1 definition of a function</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Identify increasing and decreasing intervals on a graph</td>
</tr>
</tbody>
</table>
Appendix E

Observed Lesson Standards and Descriptions
Table E1

*Observed Lesson Standards and Descriptions*

<table>
<thead>
<tr>
<th>Date</th>
<th>Essential standard</th>
<th>Lesson description</th>
<th>Memos</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>11/7</td>
<td>Standard A.REI.12 Graph the solutions to a linear inequality in two variables as a halfplane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding halfplanes.</td>
<td>Students met in two groups (one with the teacher and one with the paraprofessional) to practice graphing on a grid. Half-way through the activity, the groups switched to practice with the other task. After lunch, the students returned to revisit the task and review how to graph inequalities. Class was animated and worked with friends. Most students on task, but some distracted when working with peers. Two boys seemed to lead some disruption as they finished their work faster than others. In general, most students attentive/participating and willing to volunteer to work problems at the board. At the end of the class, student attention had decreased.</td>
</tr>
<tr>
<td>#2</td>
<td>11/9</td>
<td>Standard A.REI.12 Graph the solutions to a linear inequality in two variables as a halfplane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding halfplanes.</td>
<td>Students reviewed how to graph linear inequalities and shared strategies as a class. They then took the mastery quiz on graphing systems of inequalities. Participation was high and students willing to work together and at the board to solve problems. Students quiet during test.</td>
</tr>
<tr>
<td>3. 1/7</td>
<td>Standard F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.</td>
<td>Students completed a task of distinguishing between functions and non-functions. They then learned how to use function notation with inputs and outputs. They played Bingo as a review using candy as markers and as a prize. Participation higher than before possibly because of ease of content. New students who transferred in at the term change seemed less engaged. Two of observed students absent. Marco more distracted now that he was sitting next to girlfriend, but also more helpful to her in learning the content. Observed students were somewhat distracted by new microphones.</td>
<td></td>
</tr>
</tbody>
</table>

*(table continues)*
<table>
<thead>
<tr>
<th>Date</th>
<th>Essential standard</th>
<th>Lesson description</th>
<th>Memos</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. 1/7</td>
<td>Standard F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.</td>
<td>Students learned about features of a graph given a function including domain, range, increasing and decreasing maximum and minimum points. Students made a foldable study guide to help remember features.</td>
<td>One of the observed students was absent again. Participation and attention similar to the above.</td>
</tr>
<tr>
<td>5. 2/6</td>
<td>Standard F.BF.1.b. Combine standard function types using arithmetic operations.</td>
<td>Teacher split the students into three groups to review linearity concepts including function notation, writing equations, tables, and graphing. Lesson summary included combining these concepts the understand how to add and subtract functions.</td>
<td>General engagement was high. Students found the activity challenging at multiple levels. Students often observed helping each other, especially in the group that did not have a teacher supervisor. Lincoln absent from class.</td>
</tr>
<tr>
<td>6. 2/8</td>
<td>Standard F.BF.1.b. Combine standard function types using arithmetic operations</td>
<td>Students in rows and columns to have a review about adding and subtracting functions. The lesson was done at the Smartboard. Students reviewed linearity and completing the guided notes discussion led by the teacher.</td>
<td>Students quiet but often disengaged. Teacher wait time very short with little to no response from students. Marco and Lincoln both absent. Lacey answered a question for the first time in the observations.</td>
</tr>
</tbody>
</table>
Appendix F

Comparison of Homework
Example of Essentials Class Homework

IC © What’s your Slope
SHOW YOUR WORK FOR FULL CREDIT. NO WORK, NO CREDIT. NO WORK IN PEN.

1. Explain how you find slope from a table: ________________________________

Find the slope in the following tables.

2. \[
\begin{array}{c|c}
 x & y \\
-6 & 6 \\
-3 & 4 \\
0 & 2 \\
\end{array}
\]

3. \[
\begin{array}{c|c}
 x & y \\
-2 & -4 \\
1 & -1 \\
-1 & -3 \\
\end{array}
\]

4. \[
\begin{array}{c|c}
 x & y \\
3 & -8 \\
-5 & 16 \\
1 & -2 \\
\end{array}
\]

5. \[
\begin{array}{c|c}
 x & y \\
8 & 2 \\
-4 & -1 \\
4 & 1 \\
\end{array}
\]

6. How do you find slope from a graph:

Find the slope of the lines from the following graphs.

7. 

8. 

9. 

10. 

11. How do you know if the slope is positive OR negative from a graph? ________________________________
Find the slope of each of the lines in the following two points. HINT: Set up a table
12. (2, 3) and (4, 4) 

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

13. (−1, 2) and (1, −4)

14. (−5, 2) and (5, −2)

15. (−1, −1) and (1, 5)

16. Fill in the blanks for the following: 
\[ y = mx + b \] 
\[ m = \]

Find the slope of each of the lines in the following equations.
17. \[ y = −10x + 45 \] 
Slope: __________

18. \[ y = x − 0 \] 
Slope: __________

19. \[ y = −\frac{1}{2}x + 4 \] 
Slope: __________

20. \[ 5 + y = 3x \] 
Slope: __________

Make a table and find the slope of the line represented in the following story problems.
21. A baker makes $16 for every cake he sells at his bakery. It costs him $20 to buy the baking supplies for his cakes. Make a table (label) and find the slope showing how much money he will make for selling cakes.

<table>
<thead>
<tr>
<th># of cake</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-20</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Slope: __________

22. A mechanic charges $55 to look at your 2013 Audi R8 and he also charges $30 an hour for labor. Make a table (label) and find the slope for the amount the mechanic charges.

<table>
<thead>
<tr>
<th># of hrs</th>
<th>Total charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>55</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Slope: __________

23. I start with 64 ounces of Diet Coke each morning. Each hour I drink 3 ounces. Make a table (label) and find the slope for the amount of Diet Coke I have.

<table>
<thead>
<tr>
<th>Total soda</th>
<th># of hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>64</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Slope: __________
Example of Regular Class Homework

1A Ready, Set, Go

SHOW YOUR WORK FOR FULL CREDIT. NO WORK, NO CREDIT. NO WORK IN PEN. Due: ____________

1. The x-intercept is where the line crosses the ________. This is where ____ = 0.
2. The y-intercept is where the line crosses the ________. This is where ____ = 0.
3. \( y = mx + b \). What does the \( m \) represent? ______________. What does the \( b \) represent? ______________
4. a. Explain how you can find the slope of an equation. __________________________________________
   How about the \( x \) and \( y \) intercepts from an equation. __________________________________________
   b. Explain how you can calculate slope of a table. __________________________________________
   How about the \( x \) and \( y \) intercepts from a table. __________________________________________
   c. Explain how you can calculate slope of a graph. __________________________________________
   How about the \( x \) and \( y \) intercepts from a graph. __________________________________________

5.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
</tr>
<tr>
<td>5</td>
<td>160</td>
</tr>
</tbody>
</table>

a. Find the slope/rate of change for the table to the left. __________
   b. What is the y-intercept for the table? __________
   c. Write the equation for the line: __________
   d. Find the x-intercept for the table: __________

6.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>150</td>
</tr>
<tr>
<td>0</td>
<td>300</td>
</tr>
<tr>
<td>1</td>
<td>450</td>
</tr>
</tbody>
</table>

a. Find the slope/rate of change for the table to the left. __________
   b. What is the y-intercept for the table? __________
   c. Write the equation for the line: __________

Extra Credit: Find the x-intercept for the table.

7. Find the slope, x-intercept, y-intercept, and equation for the following graph.
   Don’t forget to write the intercepts as an ordered pair.
   a. Slope __________
   b. What is the x-intercept? __________
   c. What is the y-intercept? __________
   d. Write the equation for the line __________

Find the slope, y-intercept and x-intercept (EC) for the following equations.

8. \( y = 6x - 24 \)
   Slope: __________
   y-intercept: __________
   E.C. x-intercept: __________

9. \( -2x + y = 12 \)
   Slope: __________
   y-intercept: __________
   E.C. x-intercept: __________

Find the slope, y-intercept and equation of the line that passes through the given points.

10. \((4, 6)\) and \((10, -12)\)
   Slope: __________
   y-intercept: __________
   Equation: __________
   E.C. x-intercept: __________

11. \((3, 5)\) and \((4, 19)\)
   Slope: __________
   y-intercept: __________
   Equation: __________
   E.C. x-intercept: __________
12. The student council provided treats and paid for students to attend a ski party for Christmas. The following shows how much they spent for various numbers of students at the party.

<table>
<thead>
<tr>
<th># of students</th>
<th>Pattern</th>
<th>Resort Cost</th>
<th>Short Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
<td>$180</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>$230</td>
<td></td>
</tr>
<tr>
<td>$\text{n}$</td>
<td></td>
<td>$\text{$}$</td>
<td></td>
</tr>
</tbody>
</table>

a. Write the above data as a coordinate points. ___________________ ___________________

b. How much did the treats cost?

c. How do you know by looking at the table?

d. Is the relationship between the number of people and total cost linear? ___________________

e. How do you know?

f. What is the cost per student?

g. Show how your equation works the resort cost of the table.

E.C. Explain how to use your equation to find the cost for 20 students?

E.C. If the student council pays $1930, find how many students attended the party?

13. Josh stops at Austin’s house on his way to the gym. Austin’s mother says that Austin left a couple of minutes ago. Josh leaves Austin’s house, walking quickly to catch up with Austin. Label the graph below to show the distance and time each boy walks from Austin’s house if the grid lines are worth 1 minute (x-axis) each and 200 feet (y-axis) each.

a. Label which line is Austin and which is Josh

b. Write & label Josh’s unit rate: ___________________

c. Circle on the graph where they meet.

d. How long does it take Josh to catch Austin?

e. How far does Josh walk before they meet?

f. What is Austin’s walking rate?

g. How can you determine the walking rate by looking at the graph?

h. Each graph intersects the distance axis (the y-axis). What information do these points of intersection give about the problem?

i. Who will be farther ahead after 8 min, if they keep walking at their same rates?

j. Fill in the two tables to show Josh and Austin’s positions.

<table>
<thead>
<tr>
<th>Josh</th>
<th>Austin</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>Pattern</td>
</tr>
<tr>
<td>X</td>
<td>Y</td>
</tr>
</tbody>
</table>

l. How many minutes head start did Austin get?

m. How can you see this in the graph?

n. Estimate the x-intercept for Austin’s graph line: (______, 0)
Appendix G

Comparison of Competency Test
Example of Competency Test for Essentials Class

Unit 1 © Linear Equation EMT A
Name: ________________________

Find the slope, y-intercept and equation of each of the lines represented in the tables.

1. X Y
   0 15
   1 10
   2 5
Slope: ______ y-intercept: (0, _____)
Equation: __________________________

2. X Y
   1 10
   3 12
   5 14
Slope: ______ y-intercept: _______
Equation: __________________________

Don’t write in this box.
Slope (#1-8) _______/8
y-int (#1-8) _______/8
Write equation _______/4
Story _______/4
Bonus _______/1
Overall _______/24
% _______
You need at least 80% to pass.

Find the slope, y-intercept and equation of each of the lines represented in the graphs.

3. Slope:_______ y-intercept: (0, _____)
Equation: __________________________

4. Slope:_______ y-intercept: _______
Equation: __________________________

Find the equation of the line between the two given points. HINT: make a table
5. (2, 7) and (-2, 3)
   X  y
   2 7
   -2 3
Slope:_______ y-intercept: (0, _____)
Equation: __________________________

6. (0, 8) and (10, 13)
   X  y
   0 8
   10 13
Slope:_______ y-intercept: _______
Equation: __________________________

From the following equations, find the slope and the y-intercept of the line.
7. \( y = -\frac{1}{2}x + 3 \)
   Slope:_______ y-intercept: (0, _____)

8. \( y = \frac{7}{4}x \)
   Slope:_______ y-intercept: _______

9. You want to have a birthday party and to go roller skating on your 16th birthday. The cost at Blade and Skate is $15 for the group and $3 for each person that goes.
   a. Write the equation of the line representing the cost for going to Blade and Skate ________________________
   b. If pay for 10 people to skate at your birthday party, what will be the total cost? ________________________

10. For Halloween, you collected 38 pounds of candy. You eat 3 pounds of candy each day.
   a. Write an equation of representing the amount of candy. ____________________________
9. Find the x-intercept of #8.

10. A window washer makes $5 for every window he washes at VHMS. It costs him $25 to buy cleaning supplies. Write an equation to show how much money he will make if he is hired to wash windows if he calculates his expenses. Don’t forget to define your variables.

11. For your fundraiser for school, you decide to have a bake sale. You sell your cakes for $6 each. You start with a donation of $24 from your favorite math teacher. Write an equation to show how much money you will earn based on the number of cakes sold.
   a. Equation: ______________________
   b. If you made $156, how many cakes did you sell?

12. Write an equation parallel to the line $y = 3x + 5$

13. Write an equation perpendicular to the line $y = 3x + 5$

14. Given the equation $2x - 6 = y$, find the x-intercept.

15. Find the x and y-intercepts for the equation $3x + 4y = 12$.

   x-intercept: ____________
   y-intercept: ____________

16. You are given a $250 Netflix gift card. You have to pay $10 a month for your account from your card. Would this equation represent the amount on your card every month: $y = 10x + 250$?

   Explain:
Compentency Test for Regular-level

Unit 1: Linearity Equations EMT A  Name: ___________________________ Per: _____

Find the equation of each of the lines represented in the following tables.

1.  
<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>-3</td>
<td>19</td>
</tr>
<tr>
<td>5</td>
<td>-5</td>
</tr>
</tbody>
</table>

Slope:_________  y-intercept:_________
Equation:________________________

2.  
<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>17</td>
</tr>
</tbody>
</table>

Slope:_________  y-intercept:_________
Equation:________________________

MISSING: 1A, 1B, 1C, 1D, 1R, 1SG

Find the equation of each of the lines represented in the following graphs.

3.  
   [Graph]

Slope:_________  y-intercept:_________
Equation:________________________

4.  
   [Graph]

Slope:_________  y-intercept:_________  x-intercept: _______
Equation:________________________

Using the information given, put the following in Slope-Intercept form.

5.  \( m = 5 \), point (3, 10)

Slope:_________  y-intercept:_________
Equation:________________________

6.  \( 4x - 4 = y - x \)

Slope:_________  y-intercept:_________
Equation:________________________

Find the equation of the line between the two given points.

7.  (5, 18) and (4, 15)

Slope:_________  y-intercept:_________
Equation:________________________

8.  (-4, 11) and (3, 25)

Slope:_________  y-intercept:_________
Equation:________________________
9. A window washer makes $5 for every window he washes at VHMS. It costs him $25 to buy cleaning supplies. Write an equation to show how much money he will make if he is hired to wash windows if he calculates his expenses.
   a. Define your variables.
   b. Equation: _______________

10. For your fundraiser for school, you decide to have a bake sale. You sell your cakes for $6 each. You start with a donation of $24 from your favorite math teacher. Write an equation to show how much money you will earn based on the number of cakes sold.
   a. Equation: _______________
   b. If you made $156, how many cakes did you sell?

11. Write an equation parallel to the line $y = 3x + 5$

12. Write the equation parallel to the line $y = \frac{1}{2}x + 1$ through the point (2, 7)

13. Write an equation perpendicular to the line $y = 3x + 5$

14. Given the equation $2x - 6 = y$, find the x-intercept.

15. Find the x and y-intercepts for the equation $3x - 4y = 24$.
   
   x-intercept: __________
   y-intercept: __________

16. You are given a $250 Netflix gift card. You have to pay $10 a month for your account from your card. Would this equation represent the amount on your card every month: $y = 10x + 250$? __________

   Explain:
Appendix H

Observation Protocol
Date ____________ Student Observed: __________________________________

Lesson Topic: _______________________________ # of students in attendance: ______

**Note to Observers:** Please indicate which student is observed using a description of the student and/or the predetermined pseudonym. Please include a time in the first row with each recorded observation. Write any engagement interaction as outlined in the first column as physical behavior, verbal behavior, student-to-class tools or structure, student-to-teacher, or student-to-peer. In the last row, note any an unanticipated student interactions or engagements. A brief description and examples appear below.

**Physical behavior:** any physical action performed by the student (raising a hand, putting a head down on the desk, following instructions).

**Verbal behavior:** any verbal utterance (answering a question, yelling in frustration, humming).

**Student-to-tools:** interaction with technology (frustration with the TI-84, checking cell phone, spinning a pencil).

**Student-to-structure:** interaction with class or school procedures or expectations (having homework completed, arriving on time/late, leaving to go to the bathroom).

**Student-to-teacher:** social interactions involving authority (addressing the teacher, answering teacher questions, physical indicators like rolling eyes or shrugging).

**Student-to-peer:** social interactions involving peers (bullying, laughing with friends, isolation tendencies).

These engagement indicators may not appear in isolation, so all events should be recorded as they occur. This research memoed in a separate document. These memos allowed the researcher transparent descriptions of developing relationships between students’ actions and their engagement.

Student seat location in relation to the board: ________________________________

Please provide a general layout model of the classroom.

General tone of the classroom (happy, relaxed, structured). Please provide as much detail as possible of activities and other environment observations.
Observation Rubric

The following is a copy of the observation tool. The observer will use one copy for each observed student to note times and engagement behaviors.

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal Behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student-to-Class Tools/Structure Behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student-to-Teacher Social</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student-to-Peer Social</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal Behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student-to-Class Tools/Structure Behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student-to-Teacher Social</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student-to-Peer Social</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix I

Instructional Tools for Observed Lessons
## L4A Systems of Inequalities

### Using the coordinate grids, graph the following inequalities.

<table>
<thead>
<tr>
<th>Graph #1</th>
<th>Graph #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y &lt; -2x - 3 )</td>
<td>( y \geq \frac{2}{3}x + 3 )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Graph #3</th>
<th>Graph #4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y \geq -\frac{3}{2}x - 1 )</td>
<td>( y \leq -\frac{5}{2}x - 2 )</td>
</tr>
</tbody>
</table>

### Now, using the same grids, graph the following inequalities.

<table>
<thead>
<tr>
<th>Graph #1</th>
<th>Graph #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y \leq \frac{1}{2}x + 2 )</td>
<td>( y &gt; -\frac{4}{3}x - 3 )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Graph #3</th>
<th>Graph #4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y \leq -\frac{1}{2}x + 1 )</td>
<td>( y &lt; -\frac{1}{2}x + 2 )</td>
</tr>
</tbody>
</table>

A. Is \((2, 5)\) in the solution set for the system of #1? _______ How do you know?
B. Is \((-2, -4)\) in the solution set for the system of #1? _______ How do you know?
C. Is \((2, 2)\) in the solution set for the system of #1? _______ How do you know?
D. Is \((-4, 3)\) in the solution set for the system of #1? _______ How do you know?
E. Place a \(X\) in the solution set to each of the graphs.

---

Unit 4 Guided Notes
Unit 4 Task

**TREASURE HUNT**

An archaeologist has discovered a series of coordinates that may represent the location of buried treasures. After deciphering the coded messages, he knows that the only true coordinates of the treasures are those coordinates that lie within the solution of the system of inequalities.

The potential treasures located at the coordinates designated on the map below. The solution to the following system of inequalities is the location of the treasure.

- \( y \leq \frac{1}{3}x + 4 \)
- \( y > \frac{2}{3}x - 4 \)
- \( y > x + 6 \)
- \( y > x - 2 \)
- \( y < -\frac{1}{2}x + 3 \)
- \( y < -\frac{2}{3}x + 3 \)

The solution point lies within the solution of the system of inequalities.

**SEARCH AND RESCUE**

Search and rescue team is looking for a lost boy. They get a map of the island and using a coordinate grid decide to divide up into teams. Each team will search their area using the following inequalities. Use a different color for each team.

- A: \( y \leq \frac{1}{3}x + 4 \)
- \( x \leq 2 \)
- \( y < -3x + 7 \)

a. What landmark (if any) is NOT being searched by a search team?

b. Circle the area that will be searched by all three teams.
Unit 4 Mastery Quiz

Unit 4 Graphing Linear Inequalities and Systems

Name:____________________

Graph the following inequality

1. $y > 2x - 5$

Point Breakdown
Graphing linear _______/4
Graph System of Inequalities _______/18
TOTAL _______/22

Solve the system of inequalities by graphing. Circle OR put a X for the solution set.

2. \[ \begin{align*}
    y &\leq \frac{1}{2}x + 2 \\
    y &< -2x - 3
\end{align*} \]

3. \[ \begin{align*}
    y &\geq \frac{2}{3}x + 3 \\
    y &> -\frac{4}{3}x - 3
\end{align*} \]
Guided Notes for Unit 6

L6B Domain and Range (in-class)   Name: ________________

1. 
   Function? __________
   Domain __________
   Range __________

2. 
   Function? __________
   Domain __________
   Range __________

3. 
   Function? __________
   Domain __________
   Range __________

4. 
   Function? __________
   Domain __________
   Range __________
   Write NEW Domain/Range if there were arrows at both ends.
   D: __________
   R: __________

5. 
   Function? __________
   Domain __________
   Range __________
   Write NEW Domain/Range if there were arrows at both ends.
   D: __________
   R: __________

6. 
   Function? __________
   Domain __________
   Range __________
   Write NEW Domain/Range if there were arrows at both ends.
   D: __________
   R: __________
### Unit 6 Task

#### Discrete

When the graph contains only points.

#### Continuous

When the graph is unbroken, you can take your pencil along the graph and NOT have to pick it up.

#### Range

The Range is the set of the y-values (output) of the function. We like to say how far up and down.

#### Domain

The Domain is the set of the x-values (input) of the function. We like to say how far left and right.
Unit 9 Guided Notes

9A © Linearity Tables, Equations and Graphs

SHOW YOUR WORK FOR FULL CREDIT. NO WORK, NO CREDIT. NO WORK IN PEN.

State the y-intercept and the slope, then sketch the graph of each line.

1. \( y = 2x - 3 \)
   - y-intercept: \((0, -3)\)
   - Slope: ______

2. \( y = \frac{3}{4}x - 3 \)
   - y-intercept: \((0, \_\_)\)
   - Slope: ______

3. \( y = -\frac{1}{2}x \)
   - y-intercept: \((0, \_\_)\)
   - Slope: ______

4. Mr. Rich recently planted a crop of money trees in his garden.

A. The first tree was five inches tall when planted. It has grown four inches every month since being planted.

B. Measurements were taken of the second tree and given below:

<table>
<thead>
<tr>
<th>Months</th>
<th>0</th>
<th>2</th>
<th>3</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>3</td>
<td>12</td>
<td>16.5</td>
<td>25.5</td>
</tr>
</tbody>
</table>

C. Money Tree Growth

a. What is the rate of change (slope) for each tree? Tree A: _______ Tree B: _______ Tree C: _______

b. Which tree is growing the fastest? _______ Explain: _______

c. Which tree was the tallest when it was first planted? _______ Explain: _______

d. Write an equation to represent the growth of tree A.

f. Write an equation to represent the growth of tree C.

g. After 6 months, how tall will each tree be? Tree A: _______ Tree B: _______ Tree C: _______

So, which tree is the tallest be after 6 months? _______ Explain: _______
Provide the missing equation(s), graph, table, intercepts, and/or slope:

<table>
<thead>
<tr>
<th>Equations</th>
<th>Table</th>
<th>Graph</th>
<th>Intercepts/Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Slope Intercept | y = x + 1 | ![Graph](image) | x \(-intercept = (\_,0)\)  
y \(-intercept = (0,\_)\)  
m = \_  |
|           | x | y | ![Table](image) |
| 6.        |       |       |                  |
| Slope Intercept | | ![Graph](image) | x \(-intercept = (\_,0)\)  
y \(-intercept = (0,\_)\)  
m = \_  |
|           | x | y | ![Table](image) |
| 7.        |       |       |                  |
| Slope Intercept | | ![Graph](image) | x \(-intercept = (\_,0)\)  
y \(-intercept = (0,\_)\)  
m = \_  |
|           | x | y | ![Table](image) |
| 8.        |       |       |                  |
| Slope Intercept | | ![Graph](image) | x \(-intercept = (4,0)\)  
y \(-intercept = (\_,2)\)  
m = \(-\frac{1}{2}\)  |
|           | x | y | ![Table](image) |
Unit 9 Task

L9A Graphing LINES
Sketch the graph of each line.

1) \( y = -\frac{7}{3}x + 2 \)

2) \( y = \frac{6}{5}x - 5 \)

3) \( y = -2x - 2 \)

4) \( y = -\frac{1}{2}x + 3 \)

5) \( y = -x + 1 \)

6) \( y = 2x - 5 \)
## L9A-TABLES & Equations

<table>
<thead>
<tr>
<th>Equations</th>
<th>Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope Intercept:</td>
<td></td>
</tr>
<tr>
<td>( y = x + 1 )</td>
<td></td>
</tr>
<tr>
<td>y-intercept:</td>
<td></td>
</tr>
<tr>
<td>Slope:</td>
<td></td>
</tr>
<tr>
<td>[ \begin{array}{c</td>
<td>c} \hline x &amp; y \ \hline -1 &amp; \ \hline 0 &amp; \ \hline 1 &amp; \ \hline 2 &amp; \ \hline \end{array} ]</td>
</tr>
<tr>
<td>Slope Intercept:</td>
<td></td>
</tr>
<tr>
<td>[ \begin{array}{c</td>
<td>c} \hline x &amp; y \ \hline -1 &amp; 2 \ \hline 0 &amp; 0 \ \hline 1 &amp; -2 \ \hline 3 &amp; -6 \ \hline \end{array} ]</td>
</tr>
<tr>
<td>Slope Intercept:</td>
<td></td>
</tr>
<tr>
<td>[ \begin{array}{c</td>
<td>c} \hline x &amp; y \ \hline -3 &amp; 8 \ \hline 0 &amp; 9 \ \hline 3 &amp; 10 \ \hline 6 &amp; 11 \ \hline \end{array} ]</td>
</tr>
<tr>
<td>Slope Intercept:</td>
<td></td>
</tr>
<tr>
<td>( y = -2x + 3 )</td>
<td></td>
</tr>
<tr>
<td>y-intercept:</td>
<td></td>
</tr>
<tr>
<td>Slope:</td>
<td></td>
</tr>
<tr>
<td>[ \begin{array}{c</td>
<td>c} \hline x &amp; y \ \hline -1 &amp; \ \hline 0 &amp; \ \hline 1 &amp; \ \hline 2 &amp; \ \hline 3 &amp; \ \hline \end{array} ]</td>
</tr>
</tbody>
</table>
### L9A-STORIES Linear Equations

**1.** There are 300 fish in the pond. A crocodile is loose in the pond and is eating the fish. Each day the crocodile eats 15 fish. Make a table and write an equation.

<table>
<thead>
<tr>
<th>Time (hours)</th>
<th>Cost (dollary)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$7</td>
</tr>
<tr>
<td>1</td>
<td>$9</td>
</tr>
<tr>
<td>2</td>
<td>$11</td>
</tr>
<tr>
<td>3</td>
<td>$13</td>
</tr>
<tr>
<td>4</td>
<td>$15</td>
</tr>
<tr>
<td>5</td>
<td>$17</td>
</tr>
</tbody>
</table>

**Equation:**

---

**2.** Write a Story:

<table>
<thead>
<tr>
<th>Time (hours)</th>
<th>Water (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1000</td>
</tr>
<tr>
<td>1</td>
<td>800</td>
</tr>
<tr>
<td>2</td>
<td>600</td>
</tr>
<tr>
<td>3</td>
<td>400</td>
</tr>
</tbody>
</table>

**Equation:**

---

**3.** Write a Story

**4.** A chimp is born at the zoo and weighs 4 pounds. Each week he gains 1 pound. Complete the table and write an equation.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$f(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
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<td>10</td>
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</tbody>
</table>

**Equation:**

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Appendix J

Student Pre- and Post Self-Efficacy and Engagement Survey
Student Pre- and Post Self-Efficacy and Engagement Survey

Self-Efficacy Items
1. I believe I can do well on a mathematics test.
2. I believe I can complete all of the assignments in this mathematics course.
3. I believe I am the kind of person who is good at mathematics.
4. I believe I will be able to use mathematics in my future career when needed.
5. I believe I can understand the content in this mathematics course.
6. I believe I can get an “A” in this mathematics course.
7. I believe I can learn well in this mathematics course.
8. I believe I am the type of person who can do mathematics.
9. I feel that I will be able to do well in future mathematics courses.
10. I feel confident when using mathematics outside of school.
11. I feel confident enough to ask questions in my mathematics class.
12. I feel confident when taking a mathematics test.
13. I believe I can do the mathematics in a mathematics course.

Cognitive Engagement
14. I go through the work for math class and make sure that it's right.
15. I try to understand my mistakes when I get something wrong.
16. I would rather be told the answer than have to do the work. (reversed)
17. When work is hard, I only study the easy parts. (reversed)
18. I do just enough to get by. (reversed)
19. I don't think that hard when I am doing work for class. (reversed)
20. I think about different ways to solve a problem.

Behavioral Engagement
21. I stay focused in math class.
22. I put effort into learning math.
23. I keep trying even if something is hard.
24. I don't participate in class. (reversed)
25. I do other things when I am supposed to be paying attention. (reversed)
26. I complete my homework on time.
27. I talk about math outside of class.
28. If I don't understand, I give up right away. (reversed)

Emotional Engagement
29. I want to understand what is taught in math class.
30. I feel good when I am in math class.
31. I often feel frustrated in math class. (reversed)
32. I think that math class is boring. (reversed)
33. I don't care about learning math. (reversed)
34. I enjoy learning new things about math.
35. I get worried when I learn new things about math. (reversed)
36. I look forward to math class.
37. I don't want to be in math class. (reversed)
38. I often feel down when I am in math class. (reversed)

Social Engagement
39. I try to work with others who can help me in math.
40. I try to help others who are struggling in math.
41. I don't care about other people's ideas. (reversed)
42. When working with others, I don't share ideas. (reversed)
43. I don't like working with classmates. (reversed)
44. I build on others' ideas.
45. I try to understand other people's ideas in math class.
46. I try to connect what I am learning to things I have learned before.
Appendix K

Student Pre-Implementation Interview Questions
Student Pre-Implementation Interview Questions

Date: _______________ Place: _______________ Interviewer: _______________

Student Name: ___________________________________________

Questions:

1. How successful do you consider yourself in school in general?

2. Tell me about a class in which you felt confident in your ability to perform the assigned task.

3. What have your teachers and parents told you about your mathematics ability lately?

4. How would you describe your ability in mathematics? Explain.

5. What experiences have affected your confidence in math? How and why?

6. How do you feel about this mathematics class?

7. Tell me about some positive and negative things about this class.

8. Describe how you would act if the teacher asked you to go to the board to do a problem you did not know how to solve.

9. Would you advise other students to take this class? Why or why not?

Thank you, _________________, for your time.
Appendix L

Teacher Pre-Implementation Interview Questions
Teacher Pre-Implementation Interview Questions

Date: _______________ Place: _______________ Interviewer: _______________

Teacher Name: ________________________________________

Questions:

1. How many years have you taught this Essential Standards Class?
2. What are you general impressions about the ability of the students in this class?
3. What opportunities or disadvantages does this class present to these students in the future?
4. What have you observed in the class that makes you believe this way?
5. How do students react to the placement into this low ability grouping?
6. What changes, if any, have you seen in these students in their self-efficacy beliefs related to their mathematics ability?
7. What observations, if any, have you made about students in this class in regards to mathematics engagement?
8. Do you have any other comments about this study or intervention that you would like to add?

Thank you, _______________, for your time.
Appendix M

Repeated Measures ANOVA Results
Table M1

*Repeated Measures ANOVA Analysis Interactions Between Group and Time*

<table>
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<th>Measure</th>
<th>$F(1, 17)$</th>
<th>Sig.</th>
<th>Partial $\eta^2$</th>
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</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>0.0610</td>
<td>.8086</td>
<td>.0035</td>
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<tr>
<td>Cognitive engagement</td>
<td>1.8637</td>
<td>.1900</td>
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<td>Behavioral engagement</td>
<td>0.0274</td>
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<td>Emotional engagement</td>
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<td>Social engagement</td>
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</table>

Table M2

*Repeated Measures ANOVA Analysis Interactions Between Sex and Time*

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<th>Measure</th>
<th>$F(1, 17)$</th>
<th>Sig.</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
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<tr>
<td>Self-efficacy</td>
<td>3.3783</td>
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<tr>
<td>Cognitive engagement</td>
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<td>Behavioral engagement</td>
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<td>Emotional engagement</td>
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<td>Social engagement</td>
<td>2.212</td>
<td>.1553</td>
<td>.1151</td>
</tr>
</tbody>
</table>
CURRICULUM VITAE

LAUREN KATHLEEN MCGOVERN BURTON

Work Address:  Home Address:
Vista Heights Middle School 348 N 1350 E
484 W Pony Express Pkwy Pleasant Grove, UT 84062
Saratoga Springs, UT 84045  Cell: (801) 836-8602
Phone: (801) 610-8770 EXT 201
Email: lburton@alpinedistrict.org

EDUCATION

Ph.D.  (August 2018)
Utah State University August 2014- 2018
Pursuing a PhD in Teacher Education and Leadership in Mathematics Education

M. A. Ed. (December 2008)
Master of Education in Curriculum and Instruction: Technology, Grand Canyon University

Park City Math Institute (July 2007)
In depth 3 week course to deepen understanding in mathematics with university credit from the University of Washington.

B. A. (December 1988)
Secondary Education in English and Mathematics, Brigham Young University Teacing Certificate 6-12

TEACHING

Employment History

Utah Valley University (2017-present)
Praxis Prep Instructor
Teaching elementary education teachers the mathematics skills necessary to pass the Praxis.

Vista Heights Middle School (2010-present)
Mathematics Department
Responsibilities include developing curriculum and assessments, and teaching students
mathematics in the Utah State core from grade 7 through grade 10. As Collaborative Team Leader, additional responsibilities included planning and leading department meetings, mentoring teachers, preparing presentations for school and district meetings.  

_Utah State University Guest Instructor_ (Spring 2016)  
Presented content for a Mathematics Department Stats 1045 class.

*Mountain View High School* (June 2014)  
Taught Secondary 1 Honors during the summer break for students wanting to transition to Secondary 2 Honors for the 2014/2015 school year.

*Student Teacher Mentor* (2011-15) from Brigham Young University and Utah Valley University  
Demonstrate and evaluate best teaching practice for preservice teachers as they prepare for licensure as student teachers

_Willowcreek Middle School* (2006-2010)  
Mathematics Department  
Responsibilities included teaching mathematics to grade 8 and grade 9 students.

_Yung Wa Martial Arts Instructor* (2000-2014)  
Developed and lead instruction in Kyuki-Do, Taekwon Do, and Toru Jujutsu

_Utah State Office of Education Facilitator* (2007-13)  
Taught classes on functions and mathematics discourse in various locations in the state of Utah.

*Mountain View High School* (1989-91)  
Taught 10th and 11th grade English

_Spanish Fork Middle School* (1988-89)  
Interned as a 6th grade English teacher

**RESEARCH**

**Research Interests**

Conducting a current study on how best to help students significantly below grade level in mathematics. Developing study on how providing support for students substantially below grade level affects student self-efficacy and engagement behaviors.

Study how to develop a strong vertical alignment community within school clusters (elementary through high school) to link core concepts year to year. Show how that
would influence the performance and retention of material for students establishing a stronger base to build higher concepts later.

**Presentations**

*District Professional Development Presenter* (Fall 2015)
Lead instruction on orchestrating discourse in the classroom to other teachers in Alpine School District.

*Utah Council of Teachers of Mathematics Presenter* (November 2014)
“Unlocking the Mystery of Function Tables from Grade 7-10”

*Mathematics Parents Night Presenter* at Vista Heights Middle School (Fall 2012)
Introduce and Expound upon the New Core for Utah Mathematics

**Publications**

*Discovering Linear Equations in Explicit Tables* (March 2017) *Mathematics Teaching in the Middle School*, NCTM, Reston, VA.

**Grants and Awards**

*Presidential Award for Excellence in Mathematics and Science Teaching (PAEMST)*
Nominee (October 2016 and Spring 2015)
Nominated for efficacy with students.

*Alpine School District Accent on Excellence Award* (Spring 2014)
This award is presented by the parents, administration, and district personnel after reviewing teaching practices and efficacy of the teacher.

*Alpine School District Collaboration Grant* (2012-14)
Grant for the mathematics department for additional funds to plan and prepare classes over the summer to share and prepare best practices for the coming year.

*Alpine Foundation $3000 Grant*—to make notebooks for students (Fall 2012 for $3000)
This private donation provides each student in my classes with a notebook outlined to teach them how to take and track notes from in class.

*USTARR Teaching Grant* (2009-11)
This grant paid to improve test scores for underachieving students teach classes reviewing content to prepare students for end of level testing.

*Master’s Grant from the State of Utah (PEJEP)* (2007-2009)
This grant paid for my master’s degree.

*Qwest Technology Grant* (2008 for $2000)
Paid for the adoption of an interactive white board in the classroom so that I could record and post lessons on the Internet.

**SERVICE ACTIVITIES**

**National Service**

*LearnZillion Writer for Bill Gates Foundation* (June 2014)
Online lesson plans for Grade 7—Proportions

*LearnZillion Writer for Bill Gates Foundation* (May 2013)
Online lesson plans for high school—Exponents

**State Service**

*Facilitation in Moab* with Todd Vawdrey (October 2016)
Chosen to write facilitate an abbreviated version of Focus on Functions to Moab teachers. The course spanned content for 6th through 12th grade.

*American Institute for Research* (April 2016)
Only Utah teacher chosen to evaluate all of the SAGE questions developed for the Secondary 1 math course for alignment for depth of knowledge and content. Coded observations and worked with AIR researchers to present a final report for the USOE.

*Utah Valley University* (Spring 2016)
Designed course outline (150 hours) for Mathematics Education course to teach middle school math concepts including algebra and geometry.

*Utah STEM Technology Grant Graduate Research Assistant* (Summer 2015)
Summarized/Analyzed finding from the teacher technology grant.

*VHMS Professional Development* (Summer 2015)
Teacher PD training on Depth of Knowledge for Secondary 1.

*Alpine School District Professional Development* (Spring 2015)
Teacher PD training on Depth of Knowledge for Secondary 1 designed and implemented with Marianne Packer.

*Common Core Academy Facilitator* with Amanda Cangelosi Richfield, Utah (Summer 2013) “Functions training for Grades 7-8”

*Focus on Functions Facilitator* with Lisa Jasambah in Logan, Utah (Fall 2013)
Developing tasks and vertically aligning the concept of functions in secondary mathematics.
**Making Sense of Sense Making Facilitator** with Vicki Lyons Logan, Utah (Spring 2012) Developing discourse within the secondary classroom

**Focus On Functions Facilitator** with Todd Vawdry Price, Utah (Spring 2012) Developing tasks and vertically aligning the concept of functions in secondary mathematics.

**Making Sense of Sense Making Facilitator** with Sharon Christensen and Vicki Lyons Alpine, Utah (Fall 2011) Developing discourse within the secondary classroom

**Making Sense of Sense Making Facilitator** with Joyce Smart and Vicki Lyons Price, Utah (Fall 2011) Developing discourse within the secondary classroom

**Focus on Functions Facilitator** Utah Council of Teachers of Mathematics (Fall 2010) Developing tasks and vertically aligning the concept of functions in secondary mathematics.

**Focus on Functions Facilitator** with Lisa Jasamback in Murray, Utah (Fall 2010) Developing tasks and vertically aligning the concept of functions in secondary mathematics.

**Focus on Functions Facilitator** with Dawn Barsen in Alpine, Utah (Summer 2010) Developing tasks and vertically aligning the concept of functions in secondary mathematics.

**Focus on Functions Facilitator** Utah Council of Teachers of Mathematics (Fall 2009) Developing tasks and vertically aligning the concept of functions in secondary mathematics.

**Focus on Functions Facilitator** with Dawn Barsen in Alpine, Utah (Summer 2009) Developing tasks and vertically aligning the concept of functions in secondary mathematics.

**Secondary One Course Facilitator** in Alpine, Utah (Summer 2009) Instructing on tasks and student interaction with Secondary One content and discourse of functions in secondary mathematics.

**Local Service**

**Action Learning Mentor Team** (2015-2016) Helped design and instruct on mentoring support, policy, and training.

**Cluster Representative for Vista Heights Middle School** (2013-2015) Represent faculty to discuss issues with the superintendent and other district representative in a group including Westlake High School, Vista Heights Middle School, and all 7 feeder elementary schools.
Student Community Council Representative (2010-2013)
Represented teachers’ needs at VHMS to the council.

Mathematics Parents Night Vista Heights Middle School (2012 and 2013)
Introduce and Expound upon the New Core for Utah Mathematics

SIS Faculty Training Willowcreek Middle School (2007)
Instruct teachers how to use and take advantage of the district grading software

PROFESSIONAL DEVELOPMENT AND ENDORSEMENT

Vista Heights Middle School Mentor/Coach
(August 2017-present)
Meet with fourteen of 30 new teachers at our school to provide support, council, and advice. These meetings occur monthly or more often as needed.

Vertical Alignment Coordinator and Committee Member (2010- present)
I contacted the 5th and 6th grade teachers at all of our feeder school (13 initially) and set up meetings once a month to vertically align the curriculum among the schools. At these meetings, we discuss best practices as well as terminology and lesson plans. As a result, we have seen dramatic increase in the improvement of our incoming students as they enter the junior high. We have also developed common assessments so that those teachers recognize our expectations of incoming students and use these assessments to determine which students qualify for programs of resource, tutoring, or gifted.

Utah Council of Teachers of Mathematics Middle School Representative (January 2016-January 2018)
Support middle school math teachers and their interactions with the state and UCTM. Send emails and blog posts to inform and educate middle school teachers.

SAGE Review Committee (August 2016)
Review questions to be used for SAGE testing for ninth grade for 2017.

SAGE Item Evaluator (July 2014-2018)
Evaluating newly written items for SAGE test for implementation in the Spring of the next year.

SAGE Item Writer (July 2014–2017)
Wrote, evaluated, and advised on newly written items for SAGE test to align depth of knowledge requirements implementation for Spring of the next year.

SAGE Review Committee (August 2015)
Review questions to be used for SAGE testing for ninth grade for the upcoming year.
USU Research Coding Project (Fall 2015)
Under the direction of Sarah Brasiel, evaluating the feedback from teachers about technology grant software application in the classroom.

American Institute of Research Question Writer (Summer 2015)
Write questions to be used on the SAGE evaluative test.

District Cluster Representative for Vista Heights Middle School (2014-2015)
Represent school needs and concerns to the superintendent and other district representatives.

Vertical Alignment Coordinator and Committee Member (2010- present)
I contacted the 5th and 6th grade teachers at all of our feeder school (13 initially) and set up meetings once a month to vertically align the curriculum among the schools. At these meetings, we discuss best practices as well as terminology and lesson plans. As a result, we have seen dramatic increase in the improvement of our incoming students as they enter the junior high. We have also developed common assessments so that those teachers recognize our expectations of incoming students and use these assessments to determine which students qualify for programs of resource, tutoring, or gifted.

Common Core Training (June 2014, University of Utah)

Intern Teacher Mentor (2012-14 for Utah Valley University)
Mentor and evaluate interns in best teaching practice and aid them with concerns or conflicts throughout the year.

Curriculum Team Leader Vista Heights Middle School (2010-2014)
Attend school planning meetings and present ideas and concerns from and to the mathematics department. Also leading department meetings and professional development lessons.

Utah State Textbook Selection Committee (2009 and 2013)
Evaluate textbooks as to their suitability to fit the Utah core. These texts are submitted by publishers for adoption into math classrooms as state and district approved.

Common Core Training (June 2011 and 2012, University of Utah)

School Community Council Teacher Representative Vista Height Middle School (2010-2012)
A two year appointment to represent the needs and desires of teachers to parents and administration for the allotment of trust lands funds. Later, an accounting of funds would be presented as to the efficacy of the expenditure.

Math-in-CTE (2010-11, Nebo School District, Utah)
Statistics is Fundamental Alpine (June 2009, Utah State Office of Education)

Steering Committee Representative for Willowcreek Middle School (2008)
Attend district meetings to collaborate with other junior high and high school representatives from the district.

Professional Development Training on Skyward for Willowcreek Middle School (2008)
Develop and train the faculty on the new student grade reporting system.

CRT Proficiency Level and Evaluation Team (2008)
Evaluate the Utah state end of level assessment exam and set appropriate proficiency levels for student outcome.

Utah State Math Core College Vertical Alignment Committee (2007)
Vertically align middle school and high school content to appropriately prepare students for their college mathematics courses.