

A narrative inquiry on student perception of failing Algebra 1 and participation in subsequent high school mathematics courses

by

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B.A., Wheaton College, 2017
M.A., University of Colorado-Denver, 2021

AN ABSTRACT OF A DISSERTATION

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Department of Curriculum and Instruction
College of Education

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Manhattan, Kansas

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Abstract

Algebra 1 is significant within a student's high school mathematics coursework. Initial failure of Algebra 1 can have a continued impact on a student's subsequent mathematics coursework since prior research indicates students who fail Algebra 1 do not achieve the same level of mathematical competencies as students who initially pass. Research on the failure of students in Algebra 1 is largely quantitative; significant qualitative inquiry on the topic is lacking. Thus, the purpose of this qualitative study was to investigate how students who fail Algebra 1 describe their experience in Algebra 1 and their experiences in the subsequent years of high school mathematics coursework. This study approached the topic through a narrative inquiry methodology. Six participants who failed Algebra 1 but ultimately graduated from high school were interviewed, and the interview transcripts were analyzed using codes, categories, and patterns to identify themes. The findings were expressed through six core narratives, each an amalgamation of participant experiences. Core narratives and subsequent discussions on narratives focused on the themes of peer comparison, belongingness, social norms, student-teacher relationships, teacher commitment, and student-responsive instruction. Cross-narrative themes of engagement and perception emerged. The lasting impact of an initial negative Algebra 1 experience and the significant effect of participant feelings were addressed. The goal-oriented nature of positive experiences and the external attribution of negative experiences were also addressed. The findings of this study may be useful to teachers, school counselors, intervention specialists, curriculum leaders, teacher educators, administrators, and policymakers wanting to develop learning environments and educational practices that better support students who experience academic challenges and setbacks. The results of this study have potential impacts on school policy and classroom student support. Recommendations include the creation of a policy

addressing subsequent course enrollment following failure of Algebra 1 and the creation of a standard response protocol for initiating support for students who fail Algebra 1. Classroom recommendations include establishing a classroom culture defined by social safety, psychological safety, and active engagement, and intentionally creating a student-teacher relationship characterized by both positive social and academic interactions.

Keywords: Qualitative, Narrative inquiry, High school mathematics, Failure, Algebra 1, Perception

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Approved by:

Major Professor
Dr. Sherri Martinie

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Table of Contents

List of Tables	xi
Acknowledgements.....	xii
Dedication.....	xiii
Chapter 1 - Introduction.....	1
Statement of the Problem.....	1
Relevant Literature	1
Significance of the Problem.....	3
Study Purpose and Research Question	5
Theoretical Basis for the Study.....	5
Study Overview	5
Boundaries of the Study: Limitations and Delimitations.....	6
Limitations	6
Delimitations.....	8
Definition of Terms	9
Summary	10
Chapter 2 - Literature Review.....	12
Purpose of the Study	12
Cognitively and Instructionally Based Factors Impacting Student Success.....	13
Cognitive Development and Learning	13
Cognitive Ability	13
Neuroscience of Learning.....	14
Cognitive Overload.....	16
Educational Practices Supporting Success in Algebra 1.....	16
Classroom Implications of the Neuroscience of Learning	16
Effective Instructional Strategies.....	18
Course Placement After Failing Algebra 1.....	19
Internally Based Factors Impacting Student Success	20
Emotions and Mathematics Learning	20
Positive Emotions	20
Negative Emotions.....	21
Math Anxiety	22
Self-Efficacy	22
Low Self-Efficacy/Belief.....	22
Positive Self-Efficacy	23
Mindset	25
Growth Mindset.....	25
Mathematical Mindset	26
Attribution Theory	27
Psychological Safety	27
Environmentally Based Factors Impacting Student Success.....	28
Bronfenbrenner's Bioecological System Theory.....	28
Social Influences on Mathematics Learning.....	31
Negative Social Perspectives at Home	31
Negative Social Perspectives at School.....	32

Theoretical Framework.....	33
Cognitive Construction of Mathematical Understanding	33
Internal Beliefs and Self-Efficacy	36
Environmental Influences	38
Summary	40
Chapter 3 - Methodology	42
Research Question and Subquestions	42
Influence of Theoretical Framework	42
Subjectivity Statement	44
Why Qualitative Inquiry	45
Purpose and Standards of Qualitative Inquiry	45
Introducing and Positioning Narrative Inquiry	47
History and Theoretical Foundations.....	47
Research Design	48
Participant Selection	48
Research Site.....	52
Membership Role.....	54
Data Collection Methods	55
Data Management and Analysis	60
Data Representation	63
Ethics.....	64
Summary	65
Chapter 4 - Findings.....	67
Methodological Orientation.....	67
Tanya: Everyone Got It but Me	68
Samantha: No One to Turn (and Talk) to	69
Paul: The Social Butterfly Effect.....	72
Melissa: I Know That Teacher Hated Me.....	75
Andy: More of a Friend Than a Teacher	79
Maggie: Finally, a Teacher That Could Teach	83
Conclusion	95
Chapter 5 - Discussion.....	97
Outline of Discussion.....	97
Tanya	97
Tanya's Summary	97
Tanya's Discussion—The Power of Peer Comparison.....	97
Samantha.....	100
Samantha's Summary	100
Samantha's Discussion: The Power of Belongingness	101
Paul	104
Paul's Summary	104
Paul's Discussion—The Power of Social Norms	104
Melissa	107
Melissa's Summary.....	107
Melissa's Discussion—The Power of the Student-Teacher Relationship	107
Andy.....	110

Andy’s Summary	110
Andy’s Discussion—The Power of Teacher Commitment	110
Maggie	113
Maggie’s Summary	113
Maggie’s Discussion—The Power of Student-Responsive Instruction.....	114
Discussion of Cross-Narrative Ideas.....	117
The Power of Engagement.....	117
The Power of Perception.....	120
Research Question	121
Subquestion 1	124
Subquestion 2	127
Implications and Recommendations	129
Recommendations for Future Research	133
Conclusion	133
References.....	138
Appendix A - Study Summary for District	149
Purpose/Rationale	149
Benefits	149
Methodology	150
The Ask.....	150
Risks.....	150
Appendix B - School District Requests	152
Needs for Document Analysis	152
Needs for interviews	152
Appendix C - Initial Participant Interest Email	154

List of Tables

Table 3.1. Mathematics Course Progression for Participants	52
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Dedication

This dissertation is dedicated to the students of the real Fir Program. It was a privilege to be their teacher, and they made me a better person.

Chapter 1 - Introduction

Statement of the Problem

Success in Algebra 1 is commonly considered a primary indicator of the future success of students in high school mathematics (Stoelinga & Lynn, 2013). However, despite its agreed-upon importance by educators, the success rate of Algebra 1 students is less than desired. The experience of failing Algebra 1 is not uncommon, with one study showing a 44% course repeat rate (Fong et al., 2014). A significant number of students who experience failure in Algebra 1 also experience negative residual effects of that failure in future mathematics classes. Research has shown that failing Algebra 1 creates an insurmountable mathematics achievement gap between students who fail and those who pass (Heppen et al., 2017; Rickles et al., 2018).

This dissertation study employed a narrative inquiry methodology to better understand and explore the lived experiences of high school mathematics students who failed Algebra 1. Narrative inquiry allowed for the identification of common patterns and themes across the experiences of the study participants. The scope of this study includes Algebra 1 and subsequent high school mathematics courses. By bringing attention to how students experience and make meaning of failing Algebra 1, this research provides insight that can inform educators, school leaders, and other stakeholders as they develop more effective supports aimed at reducing the long-term mathematics achievement gap associated with initial failure of Algebra 1.

Relevant Literature

Algebra 1 holds high status in the United States public school system. It is widely considered a *gatekeeper* course because without it students are unable to access higher-level mathematics or graduate from high school (Stoelinga & Lynn, 2013). It was reported in 2019 that 90% of states required students to earn at least three mathematics credits to graduate

(National Center for Education Statistics, 2021). Although specific courses may or may not be listed, Algebra 1 is a critical step in satisfying the mathematics graduation credit requirements (Stoelinga & Lynn, 2013) because students who successfully complete Algebra 1 by the end of their ninth-grade year typically demonstrate positive attributes, such as an increased likelihood of taking advanced mathematics courses in high school, graduating from high school, and being successful in college (Stoelinga & Lynn, 2013). One study found that more than half of students entering community colleges were required to take a remedial mathematics course (Loveless, 2013). Thus, the majority of community college students did not have a sufficient grasp of basic algebra to initially progress to college-level mathematics courses. Similar statistics are true at 4-year colleges as well, with about half of freshmen requiring remedial classes (Loveless, 2013). Consequently, Algebra 1 has significant influence on high school mathematical success and beyond; therefore, considering a student's experience in Algebra 1 is critical to understanding their experiences in subsequent mathematics courses and how their initial Algebra 1 failure impacts those experiences.

Emotion and learning are interrelated; thus, the emotions felt by a student impact their academic success. Prior research has shown that there exists a profound interconnection between emotions and learning (Boaler & Dieckmann, 2026; Chen et al., 2018). Tomlinson and Sousa (2020) asserted that “emotions are a gateway to cognition and learning” (p. 18) because they impact attention and memory. Emotions are a part of the mathematical problem-solving process (Eynde et al., 2006). For example, when solving a mathematical problem that does not have an obvious solution, the solver may feel frustration or anger. Students must be able to manage those emotions effectively and use them for motivation in solving problems (Eynde et al., 2006). A commonly referenced connection between emotions and mathematics is *mathematics anxiety*, a

habitual and enduring anxiety that has emotional, cognitive, and physiological outcomes (Luttenberger et al., 2018). Less frequently discussed are positive student emotions regarding mathematics. One study explored how positive emotions such as enjoyment and pride affected the mathematical outcomes of students (Villavicencio & Bernardo, 2016). When students experienced achievement and enjoyment, they were propelled to further success and even greater performance. Despite the characterization of mathematics as a sterile topic, emotions are highly involved and influential in students' mathematical experiences in the classroom. Emotions, both positive and negative, impact student success or failure in Algebra 1 and inform their experiences in subsequent mathematics courses. As such, considering a student's emotions associated with failure of Algebra 1 can be informative and insightful to the understanding of that failure and to their experiences in subsequent mathematics courses.

How students perceive themselves and their mathematical abilities has a powerful impact on students' belief or disbelief in themselves, as has been shown in prior literature. A study conducted by Eynde et al. (2006) found that students who believed in themselves made confident choices when solving a mathematical problem. Students who did not feel confident commonly second-guessed their work at the first sign of struggle. Because self-perception and efficacy can be impacted by experiencing failure in Algebra 1 and can influence future academic endeavors, the way students make sense of themselves and their abilities is meaningful for understanding their experience of failing Algebra 1 and subsequent courses.

Significance of the Problem

A significant number of high school students are failing Algebra 1. One study of 3400 students in California found that 44% of students repeated Algebra 1, with some subgroups having nearly a 70% repeat rate (Fong et al., 2014). Such a large percentage of students needing

to repeat Algebra 1 signifies that problems exist. Moreover, the resulting consequences of failing Algebra 1 may have long-term negative effects on these students' high school mathematics achievement. Traditionally, students are enrolled in this course during their freshman year of high school. Those students who initially fail Algebra 1 fall behind their passing counterparts and generally do not achieve the same level of mathematics competency by the end of high school (Heppen et al., 2017; Rickles et al., 2018). Algebra 1 is considered the gatekeeper for higher-level mathematics, and success in this course is essential for full participation in and appreciation of future mathematics courses (Morales-Chicas & Agger, 2017). Once a student fails Algebra 1, their overall high school mathematics achievement will likely be negatively impacted (Rickles et al., 2018).

The effect on students of failing Algebra 1 has been shown in prior literature. Although those studies have documented the academic consequences of failing Algebra 1, considerably less is known about how students themselves experience that failure and make meaning of subsequent mathematics courses. This study provides insight into how students who began their high school mathematics progression by failing Algebra 1 perceived their initial failure and their subsequent high school mathematics courses. By lifting up the voices of students who have failed Algebra 1, the dynamic interplay of external and internal factors that affect their experiences were explored. The findings of this study may contribute to a broader and more robust understanding of how students experience and make meaning of academic failure in Algebra 1. By providing insight into students' perspectives, this study has potential to inform instructional practices, intervention efforts, and student support systems designed to promote learning and mathematics achievement. The findings may be useful to teachers, school counselors, intervention specialists, curriculum leaders, teacher educators, administrators, and

policymakers wanting to develop learning environments and educational practices that better support students who experience academic challenges and setbacks.

Study Purpose and Research Question

The purpose of this narrative inquiry study was to explore the lived experience of students who failed Algebra 1 and how they described their subsequent experiences in high school mathematics courses. Consequently, the following research question governed this study: *How do students who fail Algebra 1 describe their experience in Algebra 1 and their experiences in the subsequent years of high school mathematics coursework?*

Theoretical Basis for the Study

Three complementary theories informed the theoretical framework of this study's inquiry on the experience of failing Algebra 1 and enrollment in subsequent mathematics courses. From the cognitive construction perspective, *Piaget's theory of cognitive development* was used. From the internal belief and efficacy perspective, *Bandura's social cognitive theory* was used. From the environmental perspective, both Bandura's social cognitive theory and *Vygotsky's sociocultural theory* were used. The integration of components of these three constructivism theories served to develop a theoretical framework that informed this study's design, data collection, analysis, and interpretation.

Study Overview

This study employed two data collection strategies: document analysis and interviews. Document analysis was initiated through the collection of participants' high school transcripts. The academic transcripts were analyzed for two main sources of data. First, the researcher collected the mathematics courses participants had enrolled in throughout high school and their course progression. Second, the researcher collected the grades participants earned in their

mathematics courses. The researcher sought to identify trends in course enrollment and grade achievement between participants' transcripts. Academic transcript analysis also supported the development of participant interview guides.

Interviews were the primary data collection method and were conducted with a sample of high school seniors who failed their Algebra 1 course. Interviews consisted of three sessions, and all interview data were transcribed. Then, interview transcriptions were analyzed using thematic narrative analysis. Common themes were identified between participants' experiences, and these common themes were expressed in the findings through the creation of core narratives.

Boundaries of the Study: Limitations and Delimitations

Limitations

A number of limitations exist and are acknowledged for this study. Participant recollection of experiences and feelings was possibly a challenge because participants were interviewed during their senior year of high school. They were reflecting and reporting on experiences that occurred years prior; some participants even discussed elementary school experiences. Thus, a limitation of this study might be the participants' ability to recall meaningful events of their past mathematical education experiences. (The opposite is also possible. Participants had extended time to reflect and consider their previous experiences. This period of reflection may have resulted in more meaningful feedback.)

An additional limitation involved gaining access to students who were willing to participate in this study. A requirement for participation in the study was the failure of Algebra 1. Some students may have felt embarrassed or ashamed of failing, causing them to be unwilling to share their experiences. Provisions were made to support participants who became upset during interviews that necessitated recalling past experiences that may have been unpleasant. If needed,

participants were referred to the school counselor to support processing emotions that may have surfaced during the interviews. Interviews were conducted during the participants' senior year in which all were scheduled to graduate, meaning all of the participants had successfully taken subsequent mathematics courses after failing Algebra 1. The researcher initially suspected students who were able to find success in their subsequent mathematics courses after only failing Algebra 1 would be more willing to participate in this study. This proved to be inaccurate since all participants failed a minimum of one additional mathematics course after their initial Algebra 1 failure freshman year. In addition, an emphasis on community benefit was employed to encourage the participation of qualified individuals. That is, the challenge of securing the appropriate study population was specifically addressed, in part, by explaining to potential participants that the desired outcome of their participation was to improve the Algebra 1 experience of future students. The possibility that their participation could result in change in their school for the better and prevent other students from experiencing failure in Algebra 1 was, in part, a motivator for participation.

Another limitation of this study is that it was conducted in a rural school district. Currently, a disagreement exists in the literature about the existence of a *rural achievement gap*. The idea of a rural achievement gap refers to the lower academic achievement by students in a rural setting in comparison to students in a nonrural setting (Reeves, 2012). One longitudinal study of rural students' mathematical achievement found that there was no rural achievement gap based on 10th grade achievement testing. However, the same study found that a rural achievement gap is created during the final 2 years of high school (Reeves, 2012). Another study on rural mathematics education reported no rural achievement gap (Howley, 2003). The differences between rural and nonrural achievement were insignificant and, at times, favored

rural contexts (Howley, 2003). Howley et al.'s (2013) study focused on the inequities present in rural mathematics education, emphasizing the deficient view of rural mathematics achievement. The deficient view of rural mathematics asserts that the education students receive in a rural context is innately inferior to nonrural education. Despite the disagreement in the literature on whether students are likely to be disadvantaged in their mathematical achievement based on attending a rural school, the assumption that rural students are keeping pace with nonrural students in mathematics is probably false. Therefore, this research—situated within a rural context—was undoubtedly affected by that factor.

Delimitations

Decisions were made by the researcher that limited the scope of the study. These decisions created study delimitations but were deemed necessary to define a reasonable scope of study. One delimitation of this research is that the researcher only studied the mathematics experiences of participants. The researcher did not inquire about the experience of students in non-mathematics courses. Although the researcher did not intentionally approach non-mathematics educational topics, if these subjects were raised by the participants, the researcher did not stop them. Additionally, with the exception of asking how mathematics was discussed at home, the researcher did not intentionally approach home or personal aspects that may have affected participants' success in mathematics courses. These decisions were made in order to create a mathematics focus on participant responses.

An additional delimitation of this study is that participation was limited to students. The researcher did not collect additional data and context by interviewing other stakeholders in students' mathematics education, such as teachers, administrators, and parents. The researcher elected to focus on student experience in order to exclusively provide insights from the student's

perspective. These delimitations can serve as inspiration for further inquiry on the topic in the future.

An additional delimitation of this study was the researcher's decision to exclude students who were receiving special education services. This decision decreased the number of possible participants, thereby increasing the difficulty of recruiting an appropriate number of participants. The purpose of this study was not to explore the effectiveness of mathematics-focused special education services for students. The researcher felt the inclusion of students receiving special education services would lead to significantly different discussion topics than desired.

Definition of Terms

The reader's understanding of the following terms and how they are meant to specifically apply to this study is critical. Thus, definitions for those terms are now provided to offer deeper insight into the context of the research.

Failure: Failure is not earning the academic credit in a course one is enrolled in.

Fixed Mindset: A fixed mindset is “the belief that intelligence cannot be developed” (Dweck & Yeager, 2019, p. 482).

Growth Mindset: A growth mindset is “the belief that intelligence can be developed” (Dweck & Yeager, 2019, p. 482).

Internal Factors: Internal factors refer to the complex interactions between emotional, motivational, and psychological components of an individual, including their emotions, self-efficacy, mindset, and attributional beliefs.

Mathematical Mindset: According to Boaler (2016), “A mathematical mindset reflects an active approach to mathematics knowledge, in which students see their role as understanding

and sense making” (p. 59) and it “emphasizes the belief that everyone can excel in math through effort, practice, and a positive attitude” (Xu & Dieckmann, 2025, p. 2).

Narrative: A narrative is “a way of telling and knowing about human life experiences” (Kim, 2016, p. 303).

Neuroplasticity: Neuroplasticity is “the ability of the brain to undergo temporary or permanent changes whenever it is influenced by other brains and by the environment” (Tovar-Moll & Lent, 2016, p. 200).

Psychological Safety: According to Edmondson (1999), “Team psychological safety is defined as a shared belief that the team is safe for interpersonal risk taking” (p. 354).

Vygotsky’s Zone of Proximal Development: Vygotsky’s zone of proximal development is “the distance between the level of development of a student (working on problems) and her or his level of potential development (working with an adult)” (Cottrill, 2003, p. 3; Vygotsky, 1978, 1986).

Summary

This study was conducted in a rural high school in the Pacific Northwest. The researcher interviewed six high school seniors who failed Algebra 1 to gain insight into how they perceived their experiences of Algebra 1 failure and their subsequent mathematics courses. Current research on the topic reveals how students who initially failed Algebra 1 do not catch up to their counterparts who initially passed. Additionally, current research discusses how students internalize experiencing failure and how it can negatively affect their academics for the remainder of their high school years. This study contributes to the quantitative-heavy literature by providing a window into the perception of students who failed Algebra 1. Narrative inquiry methodology was employed in this study. Participants were interviewed in a series of three

meetings. Transcripts of interviews were analyzed for common themes. The common themes identified were shared using thematic narratives. Hopefully, with an increased understanding of student experience made possible by this study, educators may be able to better support student learning and academic experiences.

Chapter 2 - Literature Review

A number of possible causes for success and failure in mathematics have been discussed in the literature. It is important to note that all individuals are different, and a conclusive list of factors affecting mathematical success and failure would be impossible to develop. Overall, the causes of failure in mathematics are diverse and cannot be directly linked to one set of defining factors. However, an interplay of individual-based and societal-based causes exists that may contribute to student failure (Heyd-Metzuyanim, 2015). According to Heyd-Metzuyanim (2015), “Emotions, cognition, and social norms are interrelated in creating such trajectories of failure” (p. 544). Developing an understanding of the forces behind student failure can support the increased success of all mathematics students (Basturk, 2016). Conversely, there are many factors that contribute to mathematical success for students. As with failure, a student’s success cannot be attributed to a single cause. There exist dynamic relationships among a student’s emotions, perceptions, beliefs, and academic experiences that support their path toward success (Heyd-Metzuyanim, 2015). This literature review begins with a purpose of study and is then structured around three broad categories of factors that impact student success and failure in mathematics. These three categories are internally based, cognitively and instructionally based, and interactionally based.

Purpose of the Study

Because Algebra 1 serves as a gateway to advanced mathematics and high school graduation, failure in this course can have lasting academic consequences. It was reported in 2019 that 90% of states required students to earn at least three mathematics credits to graduate (National Center for Education Statistics, 2021). Although the specific courses may or may not be listed, Algebra 1 is a critical step in satisfying the mathematics graduation credit requirements

(Stoelinga & Lynn, 2013). Students who successfully completed Algebra 1 by the end of their ninth-grade year are more likely to enroll in advanced mathematics courses in high school, graduate from high school, and achieve success in college (Stoelinga & Lynn, 2013). Students who do not successfully complete Algebra 1 often face delayed progression through mathematics curriculum, limited access to advanced coursework, and increased risk of not meeting graduation requirements. As a result, Algebra 1 is widely recognized as a gatekeeper to future opportunities (Stoelinga & Lynn, 2013).

The consequences of inadequate algebraic understanding extend beyond high school. One study found that more than half of students entering community colleges are required to take a remedial mathematics course (Loveless, 2013). Similar statistics are true of 4-year colleges as well, with about half of the freshmen requiring remedial classes (Loveless, 2013). Thus, the majority of college students did not have a sufficient grasp of basic algebra to initially progress to college-level mathematics courses. These findings highlight the lasting impact of students' struggles with foundational algebraic concepts and reinforce the importance of understanding the experiences of students who face difficulty and failure in Algebra 1.

Cognitively and Instructionally Based Factors Impacting Student Success

Research has demonstrated that cognitive development, memory, cognitive load, and neuroplasticity shape how students acquire mathematical understanding, and instructional practices can either support or hinder these cognitive processes. These cognitive and instructional factors influence students' opportunities to succeed in mathematics and provide important context for understanding why some students struggle in Algebra 1.

Cognitive Development and Learning

Cognitive Ability

One frequently cited cause of failure in mathematics is the lack of natural mathematical ability of an individual (Basturk, 2016; Heyd-Metzuyanim, 2015). There is a pervasive idea that individuals are either innately skilled or unskilled in mathematics. This external and uncontrollable attribute provides an unavoidable perspective on mathematical failure for certain students who were not given a mathematical brain.

Additionally, a commonly held understanding of the development of cognitive ability depends on individuals progressing through different stages of understanding. Within a certain class, not all students may be in the same stage of understanding (Ojose, 2008). The different levels of understanding present may lead students to believe they are not as capable as their peers. The individuality of cognitive development means that some children may never reach the highest level of understanding, Piaget's *formal operational stage*, or they may only reach it in certain mathematical fields and not others (Babakr et al., 2019). Varying levels of cognitive development may lead students to failure, especially if teachers are not differentiating instruction to support the varying levels within the classroom.

Neuroscience of Learning

Neuroscience serves as a guide for a deeper understanding of how students learn and can also guide the implementation of scientifically based instructional strategies (Tomlinson & Sousa, 2020). Many educational theories and strategies considered effective and good practice are supported by neuroscience (Tomlinson & Sousa, 2020). The brain is not an unchangeable entity given to an individual at birth. Neuroscience shows the brain can develop and change. Education, thus, can be influential in brain development (Goldberg, 2022).

Neuroscience recognizes two types of memory involved in the learning process: working memory and long-term memory (Guy & Byrne, 2013). Long-term memory is crucial since

working memory only retains and processes 3–5 pieces of information for a short period of time (Guy & Byrne, 2013). To learn, information must transfer from working memory to long-term memory. *Semantic memory* is one type of long-term memory associated with facts and concepts that is pivotal for learning (Guy & Byrne, 2013). This semantic type of long-term memory deals with the creation of semantic frameworks—associations between ideas and concepts (Guy & Byrne, 2013). Some consider semantic frameworks the foundation of learning and thinking (Guy & Byrne, 2013).

Neuroplasticity is an additional neuroscientific concept that has profound educational effects. *Neuroplasticity* is defined as “the ability of the brain to undergo temporary or permanent changes whenever it is influenced by other brains and by the environment” (Tovar-Moll & Lent, 2016, p. 200). It has been suggested that neuroplasticity is dependent on experiences (Goldberg, 2022). Individuals must actively, as opposed to passively, participate in the learning process to activate the relevant pre-existing neural pathways required for learning. Intense and repetitive practice of a skill also supports neuroplasticity (Goldberg, 2022).

As has been pointed out, “Brain neuroplasticity is highly affected by environmental conditions and the balance between demands (challenge) and available resources (support)” (Davidson & McEwen, 2012; Goldberg, 2022, p. 2). Neuroplasticity is impacted by the environment’s “physiological integrity, cognitive challenge, [and] emotional safety” (Goldberg, 2022, p. 3; Kolb & Gibb, 2011; Petrosini et al., 2009). Physiological integrity includes the necessary bodily requirements to support an individual, such as “adequate sleep and nutrition” (Goldberg, 2022, p. 3; Kolb & Gibb, 2011; Petrosini et al., 2009). Cognitive challenge can be discussed within its relationship to Vygotsky’s zone of proximal development. When students are in their zone of proximal development, marked by demands on learning with appropriately

matched supports, neuroplasticity and learning are fostered (Goldberg, 2022). Emotional safety can be likened to a safety net. Safety nets, both social and cognitive expressed through safe adult and peer relationships, allow students to set high goals, take academic risks, and develop resilience through failure (Goldberg, 2022). Neuroplasticity supports the idea that students are able to influence their own intelligence, and their neuroplasticity can be fostered through specific environments and circumstances created by the teacher.

Cognitive Overload

Cognitive overload in students may also lead to failure. Limitations in working memory puts constraints on learning (Gupta & Zheng, 2020). Students will not be successful when asked to hold too much information within their working memory simply because their mental capacity has reached its limit. The additive nature of cognitive load cannot be more than the working memory of a student, and the overall load needs to be addressed to enable student learning (Gupta & Zheng, 2020). Cognitive overload is connected to student frustration and lower levels of motivation (Gupta & Zheng, 2020). The frustration caused by cognitive overload lessens student success.

Educational Practices Supporting Success in Algebra 1

Classroom Implications of the Neuroscience of Learning

Tomlinson and Sousa's (2020) "The Sciences of Teaching" provides an overview of direct classroom impacts that understanding the neuroscience of learning can have. These impacts include the importance of prior learning, peer interactions, and student individuality.

Neuroscience supports the importance of connecting current learning to prior learning. There is a notable positive influence prior learning has on the learning of new ideas (Tomlinson & Sousa, 2020). Some neuroscience studies suggest student retainment of new information

significantly increases when connected to prior learning and taught in a novel way (Fernández & Morris, 2018; Tomlinson & Sousa, 2020). Neurologically, if a teacher is able to support a student's understanding of how their current learning connects with prior learning, the new knowledge will be better understood (Tomlinson & Sousa, 2020).

Neuroscience supports the importance of engaging with others in the learning process. For example, "Brains have specialized cells called mirror neurons that are activated both when an individual performs an action and when he or she observes that action being done by another person" (Tomlinson & Sousa, 2020, p. 18). Learning is not a process optimized in isolation; rather, the cooperation between individuals neurologically deepens understanding and increases learning.

Neuroscience supports the importance of acknowledging and responding to a student's individuality. Students' rates of development vary by individual, and their strengths and dispositions emerge at varying times of their development (Boaler, 2016). Even before neuroscience insights, educators believed individualization of teaching is a requirement to support learning (Tomlinson & Sousa, 2020). Vygotsky's zone of proximal development is an example of a lasting educational theory now supported by neuroscience (Tomlinson & Sousa, 2020). Neurologically, students feel increased motivation and lowered stress when the learning task is within their zone of proximal development and thus more accessible to them (Baars & Wijnia, 2018; Tomlinson & Sousa, 2020). The aspect of appropriate support within a student's zone of proximal development is critical. The provided support helps students achieve a challenging task, enabling students to find pleasure in the process and learn (Baars & Wijnia, 2018; Tomlinson & Sousa, 2020). Neuroscience supports the effectiveness of supplying students with appropriate levels of challenge and support in learning.

Effective Instructional Strategies

Teachers especially have a profound impact on student success. Certain instructional strategies provide better support than others for learning. Teachers must be cognizant of the cognitive loads on individual students and intentionally manage them. Teachers should reduce extraneous cognitive load and optimize germane cognitive load for best student results (Gupta & Zheng, 2020). By intentionally managing the cognitive loads on students, teachers can maximize information going from working memory to long-term memory (Chinnappan, 2010). Also of importance to effective instructional strategies is the idea that cognitive load and student motivation are related and can impact each other. Strategies that support motivation can reduce extraneous cognitive load, and lower cognitive load shows an increase in motivated learning (Evans et al., 2024). Implementing effective load-reduction instructional strategies also supports student engagement (Evans et al., 2024).

Additionally, teachers must be cognizant of their students' prior level of learning on a topic because effective instructional strategy selection is impacted by prior knowledge (Gupta & Zheng, 2020). Instructional strategies must be appropriate for the student's prior knowledge in order to support their continued development of understanding. With the student's prior knowledge in mind, teachers can also be cognizant of fostering student time in Vygotsky's zone of proximal development. Implementing strategies that with teacher support place students in their appropriate zone of proximal development allows for continued progress (Bozkurt, 2017). Teacher support, as demonstrated by the implementation of the zone of proximal development, and peer social interactions contribute to students developing a higher level of understanding (Bozkurt, 2017). The language skills and cultural context developed when students participate in educational social interactions support learning and enable the internalization of content

(Bozkurt, 2017). The implementation of instructional strategies that foster effective teacher and peer social interactions support student learning and success.

Course Placement After Failing Algebra 1

After failing Algebra 1, students need to select a route to earn their Algebra 1 credit. This process is necessary because in most states earning an Algebra 1 credit is required for high school graduation (National Center for Education Statistics, 2021). A number of remediation options are available for students, but not every school offers all of the following options.

A student can enroll in the next course offering of Algebra 1 during the same or the following school year, or students may also choose to retake Algebra 1 during summer school. Typically, the summer school offering of Algebra 1 is a condensed version. Summer school courses are comprised of fewer seat hours than the traditional school year course, but they have a higher intensity level (Baenen, 2000). A study showed that students were more likely to pass and earn higher grades in Algebra 1 when it was repeated during summer school than during the regular school year (Baenen, 2000). However, there were no significant differences in student end-of-course achievement tests between those retaking the course in summer school and those retaking it during the following school year (Baenen, 2000).

Another option for students to recuperate their Algebra 1 credit is a credit recovery course. An estimated 89% of high schools in the United States offer credit recovery courses (Malkus, 2018). Credit recovery courses are typically offered online but have varying application specifications. For example, the course can be entirely online and self-paced or a blend of online instruction with face-to-face educational support (Rickles et al., 2018). Both entirely online and blended credit recovery courses resulted in similar outcomes for the majority of students earning their Algebra 1 credit (Heppen et al., 2017). Long-term outcomes between online and face-to-

face credit recovery options are also equivalent, but those enrolled in credit recovery courses do not catch up to those who successfully completed Algebra 1 the first time (Rickles et al., 2018).

Additionally, instead of immediately attempting to earn their Algebra 1 credit, students may simply be enrolled in the next sequential mathematics course (Heppen et al., 2017). They will still be required to eventually circle back to earn their Algebra 1 credit, but for the sake of academic scheduling, they are promoted to the higher-level courses.

Internally Based Factors Impacting Student Success

Student success in mathematics is influenced not only by cognitive development and instructional practices but also by internal processes within the individual. Student success in mathematics is influenced by a complex interaction between emotional, motivational, and psychological factors. The literature identifies several internally based factors that shape how students engage with mathematical learning and respond to success and failure, including the following: emotions, self-efficacy, mindset, and attributional beliefs. Understanding these factors provides important context for examining how students make sense of and respond to failing Algebra 1.

Emotions and Mathematics Learning

Positive Emotions

Although less frequently discussed than negative emotional factors, there are benefits to positive student emotions associated with mathematics. Tomlinson and Sousa (2020) asserted that “emotions are a gateway to cognition and learning” and that positive emotions allow for positive learning outcomes (p. 18). When positive emotions such as enjoyment, pride, and personal interest are created by instruction, memory strengthens, and more effective learning and mathematical outcomes occur (Desautels, 2016; Tomlinson & Sousa, 2020; Villavicencio &

Bernardo, 2016). This finding is supported by neuroscientific research, which indicates brain chemistry and function can be altered by the emotions produced by an individual's interactions within their classroom environments (Tomlinson & Sousa, 2020). Consequently, it is important that classroom environments foster acceptance, affirmation, and support (Tomlinson & Sousa, 2020). Students are propelled to further success and even greater performance when they experience achievement and enjoyment in mathematics class.

Negative Emotions

The effect emotion has on learning has been a significant topic of recent neuroscientific research (Tomlinson & Sousa, 2020). Numerous studies have confirmed that emotions and learning do not operate independently from each other; rather, there is a deep interconnection between emotions and learning (Boaler & Dieckmann, 2026; Chen et al., 2018). As Tomlinson and Sousa (2020) pointed out, "Emotions are a gateway to cognition and learning" (p. 18). Emotions directly affect learning because they impact attention, long-term memory, and what the student's brain elects to learn or dismiss (Tomlinson & Sousa, 2020). Neuroscience researchers assert that cognition is often stopped by negative emotions to allow the brain to focus on self-protection against threats (Desautels, 2016; Tomlinson & Sousa, 2020). Importantly, an individual's emotions and environmental perceptions affect brain function, as evidenced by a change in brain chemistry (Tomlinson & Sousa, 2020).

A specific connection exists between emotions and mathematics. Emotions are a part of the mathematical problem-solving process (Eynde et al., 2006), and "areas of the brain holding emotions about mathematics have been shown to be the same areas that are responsible for mathematical thinking" (Boaler & Dieckmann, 2026; Chen et al., 2018). When solving a mathematical problem that does not have an obvious solution, the solver may feel frustration or

anger. To be successful, students must be able to manage those emotions effectively and use them for motivation in solving problems (Eynde et al., 2006).

Math Anxiety

The most commonly known connection between emotion and mathematics is *mathematics anxiety*. Mathematics anxiety is a habitual and enduring anxiety that has both emotional, physiological, and cognitive outcomes (Luttenberger et al., 2018). Emotionally, students may feel tension or worry (Luttenberger et al., 2018). Physiologically, students may have an increased heart rate or upset stomach. Cognitively, students' working memory may be negatively impacted (Luttenberger et al., 2018). According to Young et al. (2012), when experiencing math anxiety, an individual's brain reacts to numbers in the same way it reacts when encountering snakes or spiders (i.e., shutting down the area that controls problem-solving; Boaler & Dieckmann, 2026). The various ways mathematics anxiety is embodied affects the student's ability to develop understanding and perform successfully in the academic setting.

Self-Efficacy

Low Self-Efficacy/Belief

The way students perceive themselves and their mathematical abilities is powerful. *Efficacy* is "people's beliefs in their capabilities to exercise control over their level of function and environmental demands. Unless people believe that they can produce desired effects by their actions, they have little incentive to act" (Bandura et al., 1996, p. 1206). Low self-efficacy has been shown to have numerous negative outcomes for students. With low self-efficacy, individuals cannot perform their able-level skills (Bandura & Locke, 2003). Specifically, it affects aspirations, commitment to goals, motivation, perseverance, resilience, analytic thinking, "causal attributions for success and failures," stress and depression, regulation of personal

learning and academic achievement, and the ability to master difficult concepts (Bandura et al., 1996, p. 1206).

Students with low self-efficacy are likely to doubt their work and capabilities when they experience cognitive struggle. A study found that students who believed in themselves made confident choices when solving a mathematical problem. Students who did not feel confident commonly second-guessed their work at the first sign of struggle (Eynde et al., 2006). The self-doubt that accompanies second-guessing does not support academic resilience and learning.

Student willingness to attempt challenging tasks and to strive to attain goals are also affected by self-efficacy. Low efficacy leads to visualization of failure, thus diminished motivation and performance (Bandura, 1989). Bandura (1989) noted, “People who doubt their capabilities shy away from difficult tasks. They have low aspirations and weak commitment to the goals that they choose to pursue” (p. 731). Low commitment to goals due to low self-efficacy may lead to an increased inability to meet goals, which in turn may lead to lowered self-efficacy and setting fewer goals in the future (Bandura & Locke, 2003).

Those individuals with low self-efficacy commonly attribute their failings to low natural ability (Bandura, 1989). Students are quick to characterize themselves as simply naturally not good at math. Bandura (1989) reported, “If people are not fully convinced of their personal efficacy, they rapidly abandon the skills they have been taught when they fail to get quick results or it requires bothersome effort” (p. 733). Without a belief that they are innately capable of mathematics, students tend to abandon the hope of a genuine understanding of concepts. They may rely on purely procedural fluency in mathematics to rid themselves of the struggle of creating connections and developing conceptual understanding.

Positive Self-Efficacy

Positive self-efficacy is one's belief that they are capable and able to successfully achieve a stated goal. Various benefits of high self-efficacy have been shown through previous studies. That is, high self-efficacy in students led to more efficient strategy use, higher performance, better time management, and more persistent and successful problem-solving (Bandura, 2012). High self-efficacy also supports resilience, which is necessary to be successful in a challenging task (Bandura & Locke, 2003): "In short, they [individuals with high self-efficacy] make things happen rather than just passively observe their behavioral happenings" (Bandura, 1989, p. 731). When individuals believe in their own abilities, they are more likely to put forth the required effort to attain goals and persist in their learning.

Self-efficacy influences how students approach challenges, such as learning a new, challenging mathematical concept. Optimistic views of self-efficacy can be positive because they encourage individuals to try activities that stretch their current abilities (Bandura, 1989). When an individual has high self-efficacy, they will take challenges in stride (Bandura, 1989). In addition, self-efficacy provides the tools for individuals to overcome the challenges associated with new tasks (Bandura, 1989). Also, when approaching challenges positively, high self-efficacy supports the learner's cognitive decisions. A strong belief in one's problem-solving abilities leads to efficiency when thinking analytically and when making decisions (Bandura, 1989).

The determination and attainment of goals are also affected by a student's level of self-efficacy. Higher self-efficacy leads to setting higher goals and higher motivation, persistence, and performance when attempting to meet goals (Bandura, 1989). It also leads to positive visualization and thus improved performance (Bandura, 1989). Even when someone is unable to

meet a goal, an individual with high self-efficacy will remain confident despite the struggle and will persist in striving for their goals (Bandura & Locke, 2003).

Mindset

Growth Mindset

The effects of a *growth mindset* and a *fixed mindset* have been a pervasive topic in education. A fixed mindset is “the belief that intelligence cannot be developed” (Dweck & Yeager, 2019, p. 482). A fixed mindset entails various negative effects on the process of learning. The need to achieve without struggle is emphasized since struggle and significant effort can be seen as proving low ability (Dweck & Yeager, 2019). With a negative view of effort and struggle, academic persistence also suffers (Dweck & Yeager, 2019). In comparison, a growth mindset is “the belief that intelligence can be developed” (Dweck & Yeager, 2019, p. 482). A growth mindset incentivizes engaging with challenges, putting forth high effort, learning from difficulties, and persisting through struggle because these serve to develop one’s ability and intelligence (Dweck & Yeager, 2019). Growth mindset and positive self-efficacy are interrelated and create a self-reinforcing loop supporting positive learning outcomes. Those who believe they can improve their ability are more apt to develop a growth mindset. The developing growth mindset provides positive feedback that results in increased self-efficacy (Schunk & Pajares, 2009; Xu & Dieckmann, 2025). Growth mindset is also supported neuroscientifically because brain scans show the areas of the brain associated with growth mindset and intrinsic motivation, though physically separate, activate in relation to each other (Ng, 2018; Tomlinson & Sousa, 2020).

Growth and fixed mindset are not only applicable to self; they can affect how individuals view others. Those with a more fixed mindset more strongly assert stereotypes and create more

extreme group judgments (Dweck & Yeager, 2019; Levy et al., 1998). A fixed mindset also influences how individuals make sense of new and conflicting information. Individuals with fixed mindsets accepted and more intensely emphasized new information “consistent with and supportive of existing stereotypes” (Dweck & Yeager, 2019, p. 486). Mindsets affect how individuals develop beliefs and sustain those beliefs about other individuals and groups (Dweck & Yeager, 2019).

Mathematical Mindset

Boaler’s (2016) *mathematical mindset* is a subset of the large and encompassing theory of growth mindset as presented by Dweck. Boaler (2016) asserted that a growth mindset is positive, but a mathematical mindset is critical to motivation for learning mathematics.

Individuals are not born with a knowledge of mathematics nor with the inability to learn mathematics (Boaler, 2016). A mathematical mindset “emphasizes the belief that everyone can excel in math through effort, practice, and a positive attitude” (Xu & Dieckmann, 2025, p. 2).

Being both creative and exploratory, mathematics should be considered a conceptual subject wherein growth is possible (Boaler, 2016; Xu & Dieckmann, 2025). Students must actively participate in mathematical learning and sense-making by thinking about patterns, relationships, and their connections (Boaler, 2016). The way students approach mathematics is critical since “students’ beliefs about mathematics and their own potential profoundly shape their achievement” (Boaler & Dieckmann, 2026, p. 14). Their response to challenging tasks, including their perseverance and their interpretation of mistakes, is also affected by their self-belief involving mathematics (Boaler & Dieckmann, 2026).

It is possible to develop mathematical mindsets in students, and ideally that development should begin at the onset of an individual’s interactions with mathematics (Boaler, 2016).

However, although early adoption is ideal, it is never too late for an individual to develop a mathematical mindset (Boaler, 2016). With instruction that includes an intentional emphasis on developing conceptual understanding through investigation and with mindset-focused teacher encouragement, individuals can transition to a mathematical mindset fostering achievement and enjoyment (Boaler, 2016). Mathematical mindsets in the classroom are most effective when they are “woven into the fabric of teaching and assessment” (Boaler & Dieckmann, 2026, p. 14). This process can be accomplished through selecting effective tasks that invite student exploration, providing feedback focused on progress, and fostering a “classroom culture that normalize[s] struggle as part of learning” (Boaler & Dieckmann, 2026, p. 14). The synergy of these classroom elements develops a mathematical mindset that supports higher student achievement, fosters strengthened problem-solving, and increases mathematical motivation, confidence, persistence, creativity, resilience, and agency (Boaler & Dieckmann, 2026; Xu & Dieckmann, 2025).

Attribution Theory

When a student experiences failure, they make sense of it in an individualized way. The cause or causes of failure must be attributed to some force, whether internal or external and controllable or uncontrollable. Ultimately, a student needs to be able to attribute their success or failure to specific causes or antecedents. Weiner developed the *attribution theory*, which addresses “the question of how individuals make judgements and seek to explain how they consider the causes of their behaviors and those of others” (Basturk, 2016, p. 365). After experiencing failure, how a student attributes the causes of that failure is critical for teachers to consider because they can affect the “beliefs, emotion, and behavior” of students (Basturk, 2016, p. 365). The way in which students attribute their failures and successes in mathematics speaks to the way in which they perceive themselves and the environments around them.

Psychological Safety

The way in which a student experiences their socially situated participation within a classroom impacts their group engagement. Psychological safety is a shared belief and confidence in socially safe, meaningful group engagement (Edmondson, 1999). It comprises five significant characteristics: interpersonal risk-taking, mutual trust and respect, structure and support, positive self-perception within the group, and prosocial leadership (Plouffe et al., 2023). Individuals consistently reevaluate their psychological safety within a group, therefore individuals' perception of psychological safety is dynamic (Pretty, 2026). The psychological safety a student perceives within a classroom impacts their ability to meaningfully engage in learning experiences.

Environmentally Based Factors Impacting Student Success

Student experiences in mathematics are shaped not only by their individual characteristics and instructional experiences but also by the interactions they have within their social environments. Although this study is not grounded in Bronfenbrenner's *bioecological systems theory*, the theory provides a useful lens for understanding how multiple interacting environments contribute to students' mathematical experiences. Relationships with family members, teachers, peers, and the broader educational context influence students' beliefs about mathematics, their opportunities to learn, and their responses to challenge and failure.

Bronfenbrenner's Bioecological System Theory

This study was not conducted using the bioecological systems theory, but the foundation of this theory was used for context and insight and informed the researcher's thinking. Bronfenbrenner's theory is a scientific perspective that can be implemented to describe and investigate the way humans formally and informally interact with one another and with their

surroundings (Bronfenbrenner, 1977). Bronfenbrenner believed interactions with others, varying settings, and complex contextual aspects must be considered in order to investigate human-centered topics (Bronfenbrenner, 1977). Importantly, systems outside of the individual profoundly affect the individual's lived experiences and development (Bronfenbrenner, 1994; Crawford, 2020), and the impact between an individual and their surrounding systems is not unidirectional; each impacts the other (Bronfenbrenner & Ceci, 1994; Crawford, 2020). Although this theory was originally situated within the field of psychology, Bronfenbrenner discussed its application to education and the relationships between students and their learning environments (Bronfenbrenner, 1977; Tong & An, 2024). It is important to note educational outcomes are impacted by various bioecological factors, not solely by curriculum and innate student competency (Tong & An, 2024).

The bioecological systems theory consists of four major components described in the *process, person, context, time* (PPCT) model (Bronfenbrenner & Morris, 2006; Tong & An, 2024). The interdependence and synergy between all four components—process, person, context, and time—allow for a deeper understanding of an individual's development (Navarro et al., 2022; Tong & An, 2024). Critical to PPCT's explanation of individual development is the dynamic reciprocal relationships between the individual and their environments (El Zaatari & Maalouf, 2022; Hayes et al., 2017; Rosa & Tudge, 2013; Tong & An, 2024).

The process component of PPCT encompasses the complex, reciprocal interactions between the developing individual and their surroundings, including its objects and people (El Zaatari & Maalouf, 2022). More specifically, processes are “progressively more complex reciprocal interaction between an active, evolving biopsychological human organism and the persons, objects, and symbols in its immediate external environment” (Bronfenbrenner & Morris,

1998, p. 996; Tong & An, 2024). In an educational setting, process includes an individual's reciprocal interactions with their teachers, peers, and learning materials (Tong & An, 2024).

The person component of PPCT includes the individual, who has an active role in their own development (El Zaatari & Maalouf, 2022; Hayes et al., 2017). The characteristics that define a person include, among others, temperament, motivation, age, ethnicity, race, and access to resources that impact one's ability to engage the surrounding environments (Bronfenbrenner & Morris, 2006; Tong & An, 2024)

The context component of PPCT includes the ecological systems surrounding the individual (El Zaatari & Maalouf, 2022; Krishnan, 2010). The ecological systems are described as nested structures; from smallest to largest they are *microsystem*, *mesosystem*, *exosystem*, and *macrosystem* (Bronfenbrenner, 1977). A microsystem is an immediate environment in which the individual has interactions (Tong & An, 2024). A mesosystem includes the interactions between an individual's significant environments (microsystems) at a specific point in their life (Bronfenbrenner, 1977). An exosystem is closely related to its nested mesosystem because it includes the formal and informal social structures and settings that affect the individual's environments but are outside of the individual (Bronfenbrenner, 1977, Crawford, 2020). A macrosystem is the formal and informal "overarching institutional patterns of the culture or subculture" (Bronfenbrenner, 1977, p. 515).

The time component of PPCT includes events, age, and chronological time (El Zaatari & Maalouf, 2022). Time can affect both the individual, their environments, and their interactions (El Zaatari & Maalouf, 2022; Shelton, 2019)

In reference to individual perception, Bronfenbrenner's (1977) explanation of ecological validity emphasized the importance of both the environment's "objective properties" and the

individual's perception of the environment (p. 516). W.I. Thomas's declaration, "If men define situations as real, they are real in their consequences," emphasizes the powerful impact of an individual's perception (Bronfenbrenner, 1977; Thomas & Thomas, 1928, p. 572).

In reference to relationships, Bronfenbrenner considered the development of human ecology to be most powerfully impacted by social factors (Bronfenbrenner, 1975; Crawford, 2020). He believed the integration of an individual into society was the most significant concern for healthy individual development (Bronfenbrenner, 1975; Crawford, 2020), and the effects of a negative and ineffective environment can be counteracted by a positive relationship between individuals within their environment. Further, even if an environment is positive, individual development may not take place and be optimized without positive caring relationships within the individual's environments (Bronfenbrenner, 1979; El Zaatari & Maalouf, 2022).

Social Influences on Mathematics Learning

Negative Social Perspectives at Home

"Negative attitudes towards maths from social environments" such as in the classroom or in the home may serve as reasons leading to student failure in mathematics (Basturk, 2016, p. 376; Heyd-Metzuyanim, 2015). Within their home environments, students are affected by the manner in which mathematics is discussed by those living with them, such as parents and siblings. Mathematics may be discussed in the home from a negative perspective, such as when parents or adults at home express no personal interest in mathematics or reveal a previous negative relationship with mathematics (Basturk, 2016). Students may internalize the negative feelings toward mathematics that are present in the home, thus affecting their academic performance. Additionally, based on their pre-existing mathematical abilities, parents or adults in the home may be unable to provide academic support for struggling students in mathematics,

which can also add to the negative social connotations around mathematics (Basturk, 2016).

These parental influences have been shown to have a material effect “on students’ beliefs about mathematics and about themselves as math students” (Heyd-Metzuyanim, 2015, p. 541; Parsons et al., 1982). The negative experiences and held beliefs of the previous generation can shape the self-belief of the next generation. Additionally, the belief parents hold of their children’s academic ability can affect their children’s student outcomes (Bandura et al., 1996). If a parent does not believe their child is capable of success in mathematics, that may have negative consequences on the student’s ability.

Negative Social Perspectives at School

The classroom is an additional social environment that may affect student outcomes. Heyd-Metzuyanim (2015) looked closely in a qualitative study at how the social environments of the classroom may contribute to the mathematical failure of students. Heyd-Metzuyanim explored the idea of *ritual participation* in mathematics class and how its social acceptance and encouragement may lead to failure. Ritual participation is centered around blindly following rules, both mathematical and societal. This process enables the student to provide the correct answer, which, if the developed classroom culture emphasizes the answer instead of the process, is successful participation. When simply producing the correct answer is societally and educationally desired, rewarded, and seen as proving successful understanding, students may be less willing to struggle with the deeper conceptual understandings that are required for true learning. If classroom cultures accept ritual participation, students will not develop the underlying mathematical conceptual understandings and reasoning skills needed to support future, more challenging mathematical concepts, thus leading students to future failure.

Theoretical Framework

The theoretical framework for this study consisted of three constructivist theories: Piaget's theory of cognitive development, Bandura's social learning theory, and Vygotsky's sociocultural theory. Each of these theories identify factors that impact the creation of knowledge and provide insights into the way in which an individual learns. A theoretical framework integrating aspects of all three of these theories was applied to this study in order to better understand the experiences of students when they fail Algebra 1 and how those experiences shape future mathematics engagement. The overarching structure of this theoretical framework was based on cognitive processes involved in constructing mathematical understanding, the internal influence of self-efficacy and how it impacts students' perceptions of their mathematical abilities, and environmental influences of classroom interactions, relationships, and broader social contexts. This framework, which represents the interdependency of cognitive, internal, and environmental factors, was utilized in this study in order to better understand the way in which students experience failure in Algebra 1 and experience their subsequent mathematics courses.

Cognitive Construction of Mathematical Understanding

This study utilized Piaget's theory of cognitive development as the basis for understanding the cognitive aspects of how individuals learn. Two major cognitive foundations were developed by Piaget: (1) *stages of development*—a fixed cognitive progression all individuals experience; and (2) *accommodation*—a way individuals create understanding of new information.

In Piaget's stages of development, individuals go through a transformation of their thought processes by progressing through four stages. The stages of development are continuous, and all individuals progress through the stages in the same order despite environmental and

cultural differences (Babakr et al., 2019). Although there is no skipping of stages, the timing of progression of individuals is not uniform. Individuals can go through different developmental stages at different times than their peers during their unique learning journey (Babakr et al., 2019; Ojose, 2008). The four stages of Piaget's theory of cognitive development are *sensorimotor*, *preoperational*, *concrete operational*, and *formal operational*.

The first stage is the sensorimotor stage. The sensorimotor stage begins at birth and continues until the onset of language, generally around 2 years old (Babakr et al., 2019). This stage develops object permanence and the linkage of numbers to objects (Ojose, 2008).

The second stage is the preoperational stage, and it generally lasts from 2 to 7 years of age (Babakr et al., 2019). In the preoperational stage, individuals "increase in language ability (with over-generalizations), symbolic thought, egocentric perspective, and limited logic" (Ojose, 2008, p. 27). Symbolic ability is being developed, but individuals do not have the ability to think logically yet (Babakr et al., 2019). Individuals in this stage do not possess the ability to focus on a singular aspect of an object while ignoring other aspects (Ojose, 2008). Additionally, this stage is marked by egocentrism, where children are unable "to differentiate between their perspective and others" (Babakr et al., 2019, p. 519). It is beneficial for individuals in this stage to employ manipulatives when problem-solving and to discuss their developing understandings with others (Ojose, 2008).

The third stage is the concrete operational stage, and it generally occurs from ages 7 to 11 (Babakr et al., 2019). In the concrete operational stage, individuals go through significant cognitive growth with language development and basic skills, develop an understanding of concrete things, employ their senses, consider two or three aspects simultaneously, develop seriation and classification, become less egocentric, develop the ability to solve complex

problems, and benefit from hands-on activities (Babakr et al., 2019; Ojose, 2008). In this stage, individuals still struggle to connect learning activities to the associated mathematical concepts and struggle to develop conceptual connections between multiple representations of concepts (Ojose, 2008).

The fourth stage is the formal operational stage and is generally reached at 11 years old (Babakr et al., 2019). Individuals can now think logically and work with abstract ideas (Babakr et al., 2019). Individuals within the formal operational stage can make hypotheses and consider consequences, consider abstract thinking with symbols, generalize and evaluate logical arguments, clarify (decide what is important in a problem), infer (deductive and inductive), evaluate (judge the correctness of a solution), and apply (connect to real life; Ojose, 2008). Some individuals never reach the formal operational stage, or some individuals may show formal operational understanding in a singular field and not across the board (Babakr et al., 2019).

Piaget's stages of development have been criticized because some concluded that Piaget underestimated the ability of young learners and overestimated the ability of older learners (Ojose, 2008). Further research has shown that the age specifications Piaget developed may not be accurate (Babakr et al., 2019). Nonetheless, Piaget's stages of development provide an outline of the process of cognitive development individuals progress through even though the specific ages and abilities assigned to each stage may be less rigid than initially presented.

In Piaget's theories on accommodation and assimilation, individuals have pre-existing structures of understanding that impact their perception of their experiences. The pre-existing structure of understanding, schema, allows for cognitive equilibrium within the individual. When an individual encounters an experience causing cognitive disequilibrium, there are two possibilities for response. One possible response is cognitive assimilation. If for the individual

the experience is consistent with a pre-existing conceptual structure and understanding, the new experience is assimilated into the appropriate structure, thus returning the individual to cognitive equilibrium (von Glasersfeld, 1995). The other possible response is cognitive accommodation. Without accommodation, learning would be stunted (von Glasersfeld, 1995). If the individual's experience is unable to be assimilated into a pre-existing structure of understanding, cognitive disequilibrium will occur within the individual. In order to remediate the cognitive disequilibrium, the individual must change their pre-existing structure and understanding to account for the new experience (von Glasersfeld, 1995). Piaget asserted that interaction creating disequilibrium is the most common cause of accommodation (von Glasersfeld, 1995). von Glasersfeld (1995) summarized Piaget's assimilation and accommodation learning theory as follows: "Cognitive change and learning in a specific direction take place when a scheme, instead of producing the expected result, leads to perturbation, and perturbation, in turn, to an accommodation that maintains or re-establishes equilibrium" (p. 94).

Piaget's theory of cognitive development, specifically the stages of development and accommodation/assimilation, provides an understanding of the cognitive processes an individual experiences when learning. The unique timing of and abilities within the stages of development and the relationship between new learning and pre-existing understanding are foundational to this study's inquiry on the cognitive aspect of learning.

Internal Beliefs and Self-Efficacy

This study utilized Bandura's (2012) social cognitive theory as the basis for understanding the internal, belief-driven aspects of how individuals learn. Particular attention was paid to Bandura's discussion of self-efficacy. Social cognitive theory asserts that an individual's function is caused by the interactions between "intrapersonal influences, the

behavior individuals engage in, and the environmental forces that impinge upon them” (Bandura, 2012, p. 11). Self-efficacy falls into the intrapersonal influences category Bandura identified as impactful. “Self-efficacy,” Bandura asserted, “is concerned with people’s beliefs in their capabilities to produce given attainments” (p. 15). Since self-efficacy and the entirety of social cognitive theory, is agentic, the individual has influence on their own development and actions (Bandura, 2012). The personal influence individuals possess has been categorized into three types of agencies based on similar beliefs in efficacy—*personal*, *proxy*, and *collective* (Bandura, 2012). Personal agency, also referred to as self-efficacy, refers to how individuals perceive what is within their own control. Bandura et al. (1996) noted, “In social cognitive theory, personal agency operates within a broad network of sociostructural and psychosocial influences in which efficacy beliefs play an influential regulative function” (p. 1207). Proxy agency refers to an individual’s ability to influence others with the ability to attain the individual’s desired outcomes (Bandura, 2012). Collective agency refers to an individual’s power to attain outcomes through collaboration with others (Bandura, 2012).

The theoretical framework for this study focuses on Bandura’s concepts of personal agency, or self-efficacy. Self-efficacy is developed within an individual in four ways: mastery experiences, social modeling, social persuasion, and physical and emotional states (Bandura, 2012). Self-efficacy is built through mastery experiences as an individual works through tasks finding success. For self-efficacy to be resilient to difficulty, individuals must experience success through perseverance because “resilience is also built by learning how to manage failure so that it is informative rather than demoralizing” (Bandura, 2012, p. 13). Self-efficacy is built through social modeling as an individual sees those similar to themselves persevere to success (Bandura, 2012). By seeing others similar to oneself be successful, the individual’s belief in their own

abilities increases (Bandura, 2012). Self-efficacy is also built through social persuasion. As Bandura (2012) pointed out, “If people are persuaded to believe in themselves they are more perseverant in the face of difficulties” (p. 13). Last, self-efficacy is built by physical and emotional states. Lower anxiety and depression strengthen self-efficacy (Bandura, 2012).

Self-efficacy impacts a plethora of individual characteristics that can have educational impacts, including motivation, perseverance, attribution of outcomes, emotional self-regulation, and decision-making (Bandura, 2012). Indeed, there is substantial support for the accompaniment of high self-efficacy with academic motivation and success (Bandura, 2012).

Bandura’s social cognitive theory, specifically the agential force of self-efficacy, provides an understanding of the internal processes an individual experiences that impact their learning. Individuals’ beliefs about their own ability are powerful and influential. The ways in which self-efficacy is developed and the educational outcomes associated with self-efficacy are critical to this study’s inquiry of the internal aspect of learning.

Environmental Influences

This study utilized Bandura’s social cognitive theory and Vygotsky’s sociocultural theory as the basis for understanding the environmental aspects of how individuals learn.

Environmental, in this application, refers to both the relational and societal aspects of an individual’s environment. Social cognitive theory’s reciprocal determinism and sociocultural theory’s emphasis on the effect of social interactions are two impactful insights on learning environments.

Bandura’s social cognitive theory is based on “human functioning [as] a product of the interplay of intrapersonal influences, the behavior individuals engage in, and the environmental forces that impinge upon them” (Bandura, 2012, p. 11). Environmental forces, the currently

emphasized aspect of social cognitive theory, affect how individuals perceive contexts and interact with learning and their peers. There exists a reciprocal relationship between the individual and the individual's environment (Bandura, 1978), referred to as *reciprocal determinism* by Bandura, which means that each factor has influence over the other. The individual impacts the environment, and, simultaneously, the environment impacts the individual (Bandura, 1978). Therefore, environments impact the way an individual experiences a situation.

Vygotsky's sociocultural theory addresses the impact of social interactions. Vygotsky's approach to constructivism focuses on the social and linguistic aspects of learning (Bozkurt, 2017) and asserts that learning is not individual but rather social in nature (Balbay & Dogan, 2018; Mitchell & Myles, 2004). Vygotsky considered individual and social processes interdependent for individual development and learning (Balbay & Dogan, 2018; Wertsch, 1991). In contrast to the prevailing approaches to human development of his time, "Vygotsky conceptualized development as the transformation of socially shared activities into internalized processes" (John-Steiner & Mahn, 1996, p. 192). Balbay and Dogan (2018) described "social interactions as the essence of cognitive development" in sociocultural theory (p. 65). The interactions within a society and the society itself critically contribute to an individual's learning (Balbay & Dogan, 2018; Mitchell & Myles, 2004).

Individual interactions are also impactful in sociocultural theory. Vygotsky assigned a social nature inseparable from human learning wherein an individual's development is guided and impacted by those around them (Vygotsky, 1978). A specific interaction between the individual and the teacher is given particular emphasis by Vygotsky. A major component of Vygotsky's theory is the zone of proximal development, which supports student learning by pushing the boundaries of student understanding with the support of the teacher (Bozkurt, 2017).

The difference between an individual's independent ability and the individual's ability with the supportive interaction and collaboration with a more capable individual, commonly a teacher, is the individual's zone of proximal development (Balbay & Dogan, 2018; Vygotsky, 1978). The support and interaction of the teacher enable the student to develop their personal understanding to a deeper level than would have been possible without the supportive social interaction. The individualized social interaction associated with achieving the zone of proximal development is one specific example of the ways in which interactions are impactful to learning.

Bandura's social cognitive theory's reciprocal determinism, specifically applied to the environment, and Vygotsky's sociocultural theory's emphasis on the developmental effect of social interactions provide an understanding of the environmental aspects that impact an individual's learning. Environments, including societal and relational, have educational influence. The ways in which societal and relational components interact with an individual are critical to this study's inquiry of the environmental aspect of learning.

Summary

Prior research on the topic supports the idea that success in Algebra 1 is important for continued mathematical success for students. However, there are many factors that impact a student's lack of success in Algebra 1 and subsequent classes. Factors impacting student cognition, such as neurological functions and classroom instructional methods, influence students' experiences of failure in Algebra 1. Factors impacting students' internal beliefs and dispositions, such as self-efficacy, mindset, and attribution of failure, also influence student experience. Factors impacting student environments, such as the reciprocal effect of interaction and socially accepted attitudes toward mathematics, influence a student's experience of mathematics as well. Therefore, vast cognitive, internal, and environmental influences exist that

interact to impact the way a student experiences failure in Algebra 1 and their participation in subsequent mathematics courses.

This study considered the student experience of failing Algebra 1 through a theoretical framework influenced by Piaget's theory of cognitive development, Bandura's social cognitive theory, and Vygotsky's sociocultural theory. Aspects of Piaget's theory of cognitive development, such as developmental stages and the process of assimilation or accommodation, assert the importance of cognitive construction for mathematics learning. Aspects of Bandura's social cognitive theory, such as the development and effect of self-efficacy, assert the educational impact of internal beliefs and self-efficacy. Aspects of both Bandura's social cognitive theory, such as reciprocal determinism, and Vygotsky's sociocultural theory, such as social interactions with more knowledgeable others, assert the impact of environmental influence on student outcomes. Together, the criticality of cognitive, internal, and environmental factors on student learning are represented. By applying a theoretical framework representative of the interdependent cognitive, internal, and environmental factors impacting student failure and success, a clearer understanding can be developed of how students experience failure in Algebra 1 and their experiences in subsequent high school mathematics courses.

Chapter 3 - Methodology

Research Question and Subquestions

The overriding research question that governed this study was *How do students who fail Algebra 1 describe their experience in Algebra 1 and their experiences in the subsequent years of high school mathematics coursework?* The relevant subquestions were as follows: (1) *How do students describe positive experiences in high school mathematics courses?* and (2) *How do students describe negative experiences in high school mathematics courses?*

Influence of Theoretical Framework

Aspects of Piaget's theory of cognitive development, Bandura's social cognitive theory, and Vygotsky's sociocultural theory informed the development of this study's theoretical framework. The theoretical framework focused on the cognitive, internal, and environmental factors that influence the experiences of students who failed Algebra 1 and their experiences in subsequent mathematics courses. Moreover, this study's design, data collection methods, analysis, and interpretation were guided by the cognitive, internal, and environmental theoretical framework.

The dynamic relationship between the three significant factors of the framework that impact student learning has many components. Each component is unique to the individual. For example, the level of current understanding is unique to the individual, the self-efficacy is unique to the individual, and the interactions with others in the classroom are unique to the individual. The individualized interaction of the factors impacting student learning guided the researcher to an individualized qualitative mode of inquiry. Qualitative research allowed for the inquiry to be focused on the human side of the mathematical learning experience. Narrative inquiry was selected as the research methodology because it focuses on exploring the experiences of the

individual from a personal and individualized perspective. Participants were invited to share their stories about their experiences of failing Algebra 1 and their experiences in the subsequent mathematics courses. Through the sharing of participant stories, the interplay of the theoretical framework's three significant factors was explored through their lived experiences. These experiences shared by participants were not hypothetical or artificially created; rather, they represented the participants' actual lived experiences and outcomes associated with failing Algebra 1.

Informed by the theoretical framework, the primary form of data collection was through interviews with the participants. The use of interviews to collect data is typical in a narrative inquiry study. Beyond the methodological expectation of interview use, conducting interviews to collect data supported the researcher's desire to inquire on the lived interdependence of the three significant factors of student learning. Interview questions were developed to explore the different factors of the theoretical framework. Specific questions were designed to inquire about the instructional practices experienced by students in the classroom (cognitive). Further, specific questions were designed to inquire on the student's self-perception of their ability and preparedness to be successful in Algebra 1 and beyond (internal). Last, specific questions were designed to inquire about the participant's interactions with their teacher and peers in the classroom, both social and academic (environmental). Participants, in their own words and through their own perspective, described their learning experiences that embodied the impacts of the three significant factors of the theoretical framework. Interviews allowed for the participant's sharing of experiences and stories to express what was impactful for them and how they perceived and lived their mathematics learning.

The theoretical framework informed the analysis of the data collected from interviews. The data were analyzed through the use of coding. The initial coding process was conducted using codes based on the three major factors of the theoretical framework: cognitive, internal, and environmental. Data discussing the participant's internalization of material were coded as cognitive. For example, data discussing the participant's evaluation of their abilities were coded as internal. Data discussing the participant's classroom interaction with peers were coded as environmental. This process provided an overarching classification of data to categories. From within the categories, more specific codes were developed to identify and explore pointed experiences within the larger coded categories.

The interpretation of the findings was also informed by the study's theoretical framework. Through the analysis of the data, specific experiences were identified and expressed in the findings. During interpretation, the researcher reflected on what the findings expressed about the three significant factors of the theoretical framework. The impact of the findings on the three significant factors of the theoretical framework provided a structure for data interpretation and discussion.

Subjectivity Statement

The importance of understanding how the researcher's perspective impacts quantitative and qualitative research differently was critical to generating meaningful conclusions. Qualitative research provides a unique perspective on the role of the researcher. In traditional quantitative research, the placement of the researcher within the study holds a position of objectivity and omnipotence. The researcher's role is that of a disconnected entity devoid of bias who speaks from a place of authority. The role and impact of the researcher in qualitative research contrasts with that of the quantitative researcher. For example, the researcher's presence

can be felt in qualitative research. Therefore, it was critical for this researcher to be transparent regarding her own subjectivities. This qualitative researcher attempted to bracket her own biases. The idea of bracketing one's own biases consists of both maintaining an awareness of one's own preconceptions and making an attempt to separate those preconceptions from the evaluation of data (Kim, 2016). Sharing the subjectivities of the researcher allows the reader to be aware of how the researcher may have affected or influenced the study.

The following ideas are shared to provide the reader with insights into the motivations and subjectivities of the researcher. The researcher was motivated to pursue this topic of research for two main reasons. First, the lack of qualitative analysis on the subject results in a gap in the research and an incomplete understanding of the topic. While developing an annotated bibliography on the topic of *What happens after a student fails Algebra 1?* the researcher noticed the majority of the resources on this topic were from a quantitative perspective and did not emphasize the individual experiences of the students. The second motivation was associated with the researcher's personal teaching experience. The population taught by the researcher is largely made up of students who have failed Algebra 1 more than once. Working with students with this mathematical experience and having a desire to better support those students motivated the researcher to undertake this research.

Why Qualitative Inquiry

Purpose and Standards of Qualitative Inquiry

Qualitative inquiry originated in studies based in anthropology and sociology (Bhattacharya, 2017). Researchers entered into societies different from their own and studied the people, their cultures, and their rituals. This practice allowed researchers to develop thick descriptions and recognize themes regarding these previously unknown cultures. Readers were

able to get a sense of these previously unknown societies and expand their understanding (Bhattacharya, 2017). Although this may describe the beginnings of qualitative inquiry, the current practices are distinct from their origins because the early foundations of qualitative research treated those studied as objects to be observed rather than humans who are actively participating in the research process.

Current qualitative research approaches the studied context from a more humanistic perspective. The qualitative researcher believes that the human condition cannot most effectively be studied using cut-and-dry objective methods. Rather, the experience of individuals is a messy situation, and the researcher must approach their research in ways that are appropriate for the inquiry (Kim, 2016). Additionally, qualitative inquiry allows for a constructivist perspective on the creation of knowledge. Chand (2023) described constructivism as “a theory of learning or meaning-making that enables people to create their own new understanding based on an interplay between what they already know and believe and the concepts and knowledge with which they interact” (p. 274). This study focused on the experience of individuals. In order to gain an understanding of the students’ experience, it was critical to understand how experiences are constructed.

Qualitative research can take a plethora of forms that are vastly different from one another. Due to the variety of approaches to qualitative research, there are no steadfast standards. This precept does not mean that qualitative researchers are without guides for developing a meaningful study (Kim, 2016). The Council of the American Educational Research Association (AERA) developed standards for humanities-oriented research, including narrative inquiry qualitative research (2009). The seven standards AERA (2009) developed are *the significance of*

research, conceptualization, research design, substantiation, coherence, quality of communication, and ethics.

Introducing and Positioning Narrative Inquiry

History and Theoretical Foundations

This study was conducted under the large umbrella of qualitative research and specifically implemented narrative inquiry. Bruner is acknowledged as one of the main contributors to the field of narrative inquiry (Kim, 2016). Bruner suggested that reality and truth can be understood in a paradigmatic mode and a narrative mode (Bruner, 1986). The paradigmatic mode is the scientific thinking perspective influenced by positivism and quantitative research. In contrast, the narrative mode develops an understanding of life and its events by using stories. In the narrative mode, the importance of time and place is emphasized because they are inseparable from the sharing of a story. Each story is affected by its context in explicit and implicit ways that should be considered.

Additionally, the human aspects of the participants sharing their stories are also critical. The participants' motivations, feelings, and perceptions as the storytellers are foundational for developing an understanding. As with any venture into humanity, this process comes with complexity and ambiguity that are unique to a narrative mode of understanding (Kim, 2016). Implementing a basis of understanding founded on individuals' shared lived experiences is the foundation of narrative inquiry.

By approaching research through the lens of narrative inquiry, the researcher collects and shares the stories and experiences of participants (Kim, 2016). The narrative inquiry approach has been described as a methodology of storytelling (Kim, 2016). The findings of this study are a collection of experiences articulated by the participants. By hearing and analyzing the stories of

students, the researcher endeavored to develop an understanding of the human experience associated with failing Algebra 1 and participating in subsequent math courses. Narrative inquiry can also serve emancipatory purposes because it can elevate the voices of groups that may not typically get their voices heard (Daiute, 2014). Narrative inquiry provides a deep insight into a small group of individuals' experiences. The sharing and analysis of those experiences are intended to spur self-reflection within the reader and open their minds to alternative perspectives. Narrative inquiry has been employed in various fields, such as psychology, law, medicine, and education (Kim, 2016). The term narrative inquiry was first used in the education field by Connelly and Clandinin in 1990. Narrative inquiry is appropriate in an educational context since it is a way to organize the individual's contextualized experiences, and education is based upon the individual experiences of students (Kim 2016).

Research Design

Participant Selection

There is no widely accepted appropriate sample size for qualitative studies (Beitin, 2012). Some qualitative theorists have provided suggestions as starting points for sample size, such as 6 to 15 and 15 ± 10 (Beitin, 2012; Kvale, 1996). The determination of sample size is affected by the objectives of the study and the type of data that will be collected. Additionally, the idea of saturation should be considered when determining if the sample size of a study is adequate. Reaching the point of saturation with data means that no new information or knowledge is being shared within data collection (Suarez-Ortega, 2013). Once the data being gathered repeat data gathered prior or confirm ideas already shared, the point of saturation has been achieved (Suarez-Ortega, 2013). The researcher must consider that a true saturation of data is not possible based on the idea that the data being collected are individual experiences of participants.

The number of participants selected was based on deMarrais' (2004) discussion of the generation of data from interviews and data saturation (Suarez-Ortega, 2013). A quality interview that is 1.5 hours long will generate 25–30 pages of transcript text (deMarrais, 2004). Therefore, an hour-long interview will generate an estimated 16–20 pages of data. Based on conducting three 1-hour-long interviews with each participant, an estimated 50–60 pages of data were generated by each participant. Although deMarrais' discussion provides a general guideline for anticipated data collected from interviews, the final determination of sufficient participation numbers was based on the concept of data saturation and participant interest.

The population was students who met the three study requirements. The sampling was conducted through voluntary response sampling. Voluntary response sampling was an acceptable approach because this research was focused on a specific, unifying event between participants, and there was not an attempt to develop generalizations about the entire population of the graduating student body. The themes developed by the researcher did not attempt to transform the identified themes into generalizations about the entire population. Rather, the goal was to find meaning within the stories of the individuals (Ewick & Silbey, 2003).

There were a total of six participants in this study. Participants were students who attended Pacific High School who met the following requirements: (1) they were scheduled to graduate during the 2024–2025 school year, (2) they failed Algebra 1, and (3) they were willing to participate in a series of interviews. First, participation was limited to students graduating in the 2024–2025 school year. This allowed for insight into almost the entirety of their high school experience. Although students were not entirely done with their coursework, they had progressed to a point that allowed for reflection on their personal experiences and growth. Second, participants must have been enrolled in and failed Algebra 1 during their 1st year of high school.

This provided a common experience for participants. Third, participants must have been willing to participate in all three of the interviews for the study. Participation in all interviews was needed to enable the sharing of their experiences on a variety of topics of inquiry. With the research focused on gaining an understanding of individual experiences, the in-depth nature of interactive interviews was critical.

Participants were selected through a recruiting process. The principal of Pacific High School obtained a list of students who met the study participation requirements from the academic counselors. Of all possible students, 16 met the participation requirements for this study. The researcher then contacted all possible participants via their school emails. Since the researcher was employed at the school district, the email was from a trusted domain. The initial interest email (see Appendix C) resulted in one response. A follow-up email was sent to possible participants who had not responded to the initial interest email. The first follow-up email resulted in one additional response. In order to increase interest in participation, the gift card incentive amount was increased for the third follow-up email. The third follow-up email resulted in one additional response. Additionally, an initial interest email was sent to qualifying students at the Fir Program. This email resulted in three additional responses. All students, regardless of specific point of recruitment, received equal gift card incentive amounts. At the conclusion of the recruitment process, the study had six total participants. All participants who began the interview process were retained throughout the completion of data collection for this study.

Additionally, in order to encourage participation in the study, specific students were individually invited to participate by school administration. The Pacific High School principal identified specific students who she expected to be receptive to participation. She individually

invited their participation in the study. This strategy did not result in any additional student participation.

Ideally, participation in the study was viewed as a mutually beneficial experience for both the researcher and the participants. Three benefits were shared with participants. First, students received a \$100 gift card to a local coffee shop. Providing this incentive for participants was a way to show appreciation for their time and willingness to share their personal experiences. Second, participants received a collection of school spirit wear provided by Pacific High School. Third, participation in the study might benefit future students since the study results may be used to improve future student experiences and success in Algebra 1. The researcher explained to participants how their participation could contribute to an increased understanding of the student experience and might serve for the betterment of future students.

The sample consisted of six individuals, all who met the participation criteria. One participant was male and five participants were female. Three of the participants transferred into the Fir Program (alternative education program) at some point in their high school experience. The progression of mathematics course enrollment was unique to each participant. Each participant's course progression is represented in Table 3.1.

Table 3.1. Mathematics Course Progression for Participants

Participant A	Participant B	Participant C	Participant D	Participant E	Participant F
Algebra 1A (F)	Algebra 1A (F)	Algebra 1A (F)	Algebra 1A (F)	Algebra 1A (F)	Algebra 1A (F)
Algebra 1B (F)	Algebra 1B (D)	Algebra 1B (F)	Algebra 1B (F)	Algebra 1B (F)	Algebra 1B (D)
Algebra 1A (F)	Integrated 1 (B)	Algebra 1A (F)	Algebra 1A (F)	Algebra 1A (F)	Integrated 1 (C)
Integrated 1 (B)/Algebra 1B (C)	Algebra 2A (B)	Integrated 1 (D)	Integrated 1 (D)	Integrated 1 (B)	Algebra 2A (F)
Integrated 1A (B)	Algebra 2B (F)	Integrated 1A (A)	^a Algebra 1B (A)	Integrated 1A (C)	Algebra 2B (F)
Integrated 1B (B)	Geometry A (F)	Integrated 1B (B)	^a Geometry A (A)	Integrated 1B (B)	^a Geometry A (B)
Integrated 1C (B)	Geometry A (C)	Integrated 1C (B)	^a Geometry B (A)	Integrated 1C (F)	^a Geometry B (B)
Geometry A (B)	Integrated 1C (A)/ Geometry B (C)	Integrated 2A (A)	^a Algebra 2A (A)	^a Geometry A (C)	^a Algebra 2A (A)
Geometry B (C)	Pre-Calc A (B)	Integrated 2B (C)	^a Algebra 2B (A)	^a Geometry B (B)	^a Algebra 2B (A)
	Math 111 (B)/Algebra 2B (A)			^a Algebra 2A (C)	

Note. Final Course Grade is indicated in parentheses. Courses listed together indicate concurrent enrollment.

^aCourse completed through Fir Program.

Research Site

Initial approval to conduct this study was pursued at the school district level. The researcher requested a meeting with the school district superintendent via email and provided a summary of the intended research (see Appendix A). The researcher attended an in-person meeting with the superintendent, at which time the superintendent's questions were addressed. The superintendent requested two items from the researcher. The first item was the submission to

the district of an official request to conduct research. The second item was a brief list of specifics the district would be required to provide. At the conclusion of the meeting, unofficial approval was given by the superintendent. Following the submission of the official request and the provision of district requirements (see Appendix B), official approval was given by the superintendent and school district to conduct research. The researcher then requested a meeting with the Pacific High School principal to provide communication and clarity around the specifics of the research. Prior to meeting, the principal was provided with a summary of the study (see Appendix A). At the researcher's meeting with the principal, the principal provided positive feedback on school participation in the study. Support was expressed, and the researcher's request for collaboration on a list of potential participants was accepted. A tentative participant recruitment and data collection timeline was created. The researcher and school district had a positive working relationship throughout the duration of the study.

Data collection occurred at Pacific High School. Providing a clear description of the research site allows for a more complete understanding of the context wherein data were collected. Pacific High School is situated in a rural community in the Pacific Northwest, roughly 2 hours outside of a major metropolitan area. The following demographic information was provided by the school district. Pacific High School serves roughly 725 students. The ethnicity makeup of students is 66.3% White, 26.7% Hispanic, 4.3% two or more races, 0.7% American Indian/Alaska Native, 0.7% Asian, 0.4% Black, and 0.4% Native Hawaiian/Pacific Islander. Students' gender is split between 51% female and 49% male. A total of 34% of students qualify for free and reduced lunch, and the graduation rate of Pacific High School is 80%.

Interviews were conducted on Pacific High School grounds. All interviews occurred in a school conference room. Situating interviews at the school allowed for data collection to occur in

a location familiar to the students and one in which they were comfortable. Interviews were generally conducted at the participant's convenience. The majority of interviews were conducted immediately following the conclusion of school hours while after-school activities were still occurring on campus. If participants were unable to attend an after-school interview session, alternative scheduling was agreed upon.

Membership Role

The researcher was both an insider and an outsider to different aspects of the study. First, the researcher will address the ways in which she was an insider to the research. The researcher lives within the small, rural community where the study was conducted. This element may have provided insight into regional and community intricacies that may influence the participants. Second, the researcher is a mathematics teacher in the same district in which the research was conducted. Therefore, the researcher may hold prior convictions on the current state of the mathematics department within the district.

Second, the researcher will address the ways in which she was an outsider to the research. Although the researcher has lived within the community for a number of years, she is not a native of the town. Therefore, the researcher is not entirely entrenched within the generational culture of the community and, in turn, may be considered an outsider by some subset of the population. In addition, the researcher is not an active member of the Pacific High School mathematics department. Therefore, she is not privy to the internal decision-making for the department.

Although the researcher is a high school mathematics teacher in the district, she teaches in the alternative education program, separate from the traditional high school. This means participants from the traditional Pacific High School did not have a prior relationship with the

researcher but may have had some familiarity with her. Participants who were enrolled in the alternative education program, denoted as the Fir Program within this study, were previous students of the researcher. The researcher served as the stand-alone mathematics department in the Fir Program, developing and instructing all mathematics courses. Overall, there is no simple identification of the researcher as an insider or outsider. The researcher situated herself within aspects of both.

Data Collection Methods

Data were collected through the application of two methods. The first method consisted of document analysis. The high school transcripts of participants were collected from the school district. The pertinent information from the participants' academic transcripts included the mathematics courses students enrolled in, the order of the enrollment, and the grades earned in each course.

The second data collection method consisted of conducting interviews with participants. Narrative inquiry methods commonly emphasize the use of interviews to collect data. This is to facilitate the sharing of stories and personal experiences (Daiute, 2014). Dolbeare and Schuman's three-interview series served as the starting point for the development of the researcher's interview process (Schuman, 1982; Seidman, 2019). Within the three-interview series, the first interview focuses on the participant's life history with respect to the study's topic. The second interview focuses on the details of a specific experience, which is the topic of study. The third interview serves as a self-reflection on their experiences. The third interview must be predicated on the first two interviews since they provide context for self-reflection (Seidman, 2019). Seidman (2019) described the critical nature of contextualized interviewing as follows:

“People’s behavior becomes meaningful and understandable when placed in the context of their lives and lives of those around them” (p. 16).

The study’s three-interview series also served to develop a robust context to enable deeper understanding of meaning and behavior. Interviews were structured around participants’ mathematical educational experience in three phases: experiences prior to Algebra 1, experiences in Algebra 1, and experiences following Algebra 1. The first interview focused on mathematical experiences prior to Algebra 1. This provided extensive context within which to situate the data. The second interview focused on the details of the participants’ unifying and shared experience of failing Algebra 1. The third interview focused on details of their experiences in subsequent mathematics courses and overarching reflection on their mathematics experience. Each participant had a unique perspective based on their lived experiences, and implementing this interview structure supported the contextual examination of their shared stories.

Interview questions were developed with the intent to elicit stories from the participants. Both descriptive and evaluative questions were included in the interview guide (deMarrais, 2004; Whyte, 1984). These two types of questions facilitate different contributions from the interviewee. Descriptive questions serve to gain the particulars of a specific event (deMarrais, 2004; Whyte, 1984). Evaluative questions are “a request for an assessment of how the participant feels about that event or happening” (deMarrais, 2004, p. 63; Whyte, 1984). The inclusion of descriptive and evaluative interview questions was necessary to allow for the sharing of participants’ stories and for their own evaluation of specific experiences. This strategy allowed for increased fidelity to the participant’s perception.

Questions were worded concisely and clearly and structured broadly and open-ended to facilitate the sharing of rich data from participants (deMarrais, 2004; Bhattacharya, 2017). Close-

ended questions were intentionally infrequently used since they generally do not allow for meaningful elaboration from the participant (deMarrais, 2004). As is common when interviewing individuals, some participants' responses were initially briefer than other participants'. Therefore, to achieve the researcher's desire for in-depth responses, effective elements of interviewing were intentionally emphasized. These paramount interviewing elements were active listening and probing for elaboration (deMarrais, 2004). The researcher took note of ideas shared by participants that had unspoken precursors or unspecified meaning and probed the participant to expand further. The general probe of *Tell me more about ...* was typically sufficient to spur the participant into further explanation or continued sharing (deMarrais, 2004). This routine allowed for richer stories to be shared by participants.

The researcher reflected upon her own subjectivities throughout the development of interview questions (Bhattacharya, 2017). When developing the interview guide, the researcher was aware of possible unintended consequences of the wording of questions. The researcher developed questions to ensure she was not unintentionally leading participants to a specific response or casting a concept in a specific light. To minimize the researcher's bias within questions, the researcher reflected upon each interview question for purpose and intent. Each interview question was linked to a portion of the research question or subquestions. This feature supported the intentionality and purpose of each interview question.

Each interview began with a brief opening statement thanking the participant for their participation and providing a broad goal for the meeting. Participants were also given the opportunity to ask questions regarding their participation in the study. Throughout the interviews, when the researcher transitioned from one topic to a new topic, a brief framing statement was shared by the interviewer. The framing statements were included to provide

clarification and focus for each interview section. The framing statement explicitly served to make the participant aware of the new topic of discussion and to focus the participant on their mathematical educational experience that was relevant to the section of the interview. All interviews concluded with a brief closing statement. The closing statement provided participants with the opportunity to bring up topics they deemed relevant but that had remained undiscussed. It also allowed for participants to ask questions, be thanked for their participation, and be reminded of the time and topic of their next scheduled interview.

All interview questions were consistent between participants for the first and second interviews. The first interview had two purposes. The first purpose was to develop rapport between the participant and the researcher, and the second goal was to gain insight into the participant's mathematical experiences prior to Algebra 1 (deMarrais, 2004). The second interview's main purpose was to address the participant's experience specifically in Algebra 1 during their freshman year. Because the course progression was similar for all participants in regard to Algebra 1 and the prior courses, the researcher deemed it appropriate and correct for interview questions to be consistent between all participants for Interview 1 and 2.

The researcher developed individualized interview guides for each participant's third interview. The purpose of the third interview was to gain insight into the participant's experiences following their enrollment in Algebra 1 during their freshman year. This interview followed the chronological progression of the participant's mathematics course enrollments throughout the entirety of high school, excluding the initial enrollment in Algebra 1. Since each of the participants had a unique progression of course enrollment, the researcher found it appropriate to prepare interview guides specific to each participant. Previously collected academic transcripts were utilized to develop guides for the third interview. The interviews were

segmented to represent each of the participant's subsequent mathematics course enrollments. The framing statements at the beginning of each segment provided the participant with the course to be discussed and their grade earned in that specific course. The framing proved beneficial because some participants struggled to recall the progression of courses they were enrolled in and their final grade for each course. Although the progression of courses was unique to each participant for Interview 3, the specific interview questions were similar. For each course, participants responded to the same interview questions. This process allowed for both continuity between participant's prior interviews and consistency between participant interviews.

Interviews were conducted by both the researcher and two third-party individuals. Participants who solely attended Pacific High School were interviewed by the researcher. Participants who attended the Fir Program were interviewed by third-party interviewers since the researcher was the math teacher for all participants who attended the Fir Program. The researcher deemed it inappropriate to conduct the interviews for those participants from within the Fir Program. Participants may have felt uncomfortable sharing classroom experiences that they classified as negative directly to their mathematics teacher. Although participants from within the Fir Program were aware their interviews would go to the researcher, their mathematics teacher, a level of separation was created to allow for increased participant comfort. The third-party interviewers were other teachers within the Fir Program. This choice was made intentionally to develop a safe and comfortable interviewing environment for participants. Third-party interviewers completed Collaborative Institutional Training Initiative training through the researcher's institution and were trained by the researcher on how to effectively conduct interviews. The researcher provided the third-party interviewers with the interview guides and an explanation of the purpose of the specific interviews. These materials were provided to the third-

party interviewers prior to their interview sessions to allow the third-party interviewers to gain familiarity with the materials and allow the researcher to provide any clarification requested by the interviewers.

Data Management and Analysis

Two sources of data were analyzed. The first source of data analyzed was from the collection of participant transcripts. Transcripts were provided by Pacific High School in digital format. Digital copies of participant transcripts were securely stored on a password-protected Google Drive. Academic transcripts were not printed for security purposes and were solely accessed by the researcher via Google Drive. The researcher collected three pieces of data from each participant's transcript. The first piece of data was the mathematics courses participants enrolled in during their 4 years of high school. The second piece of data was the progression participants followed while completing their mathematics courses. The third piece of data was the grades earned in each mathematics course. These data were analyzed for themes common to the participants' experiences. It is essential to note the limited view of student experience that is provided by solely reviewing a transcript. The transcript provides an uncontextualized window into a participant's educational progression. Transcripts alone would not have allowed for an impactful analysis of the student experience. The analysis of transcripts served as a supporting source of data, whereas the analysis of interviews served as the primary source of data.

The second source of data analyzed was the participant interviews. Interviews were audio recorded with the participant's permission. Zoom was used to create audio recordings of interviews. The camera feature was disabled, thus allowing for solely an audio recording. The audio recording was downloaded to and securely stored on the researcher's password-protected Google Drive. Audio recordings were transcribed for ease of analysis. Transcripts of interviews

were stored on the researcher's password-protected Google Drive. Interview transcripts were physically printed for ease of analysis. When not in use, physical copies of interview transcripts were stored at the researcher's residence in a lockbox.

Kim (2016) described two ways to analyze narratives. The first is the analysis of narratives, and the second is narrative analysis. Although similar in nomenclature, the outcomes of these two are significantly different from one another. The unique goals and outcomes of each method to analyze narrative data are discussed below.

The analysis of narratives is a method to explore narrative data collected through interviews. This form of analysis identifies common themes throughout the data collected (Polkinghorne, 1995). Unique themes and commonalities between multiple data sources are identified (Polkinghorne, 1995). The purpose of analysis of narrative is to "produce general knowledge from a set of evidence or particulars found in a collection of stories" (Kim, 2016, p. 197). Theme identification through the analysis of narratives can be categorized into three specific types. One type applies previous literature, theory, and researcher logic to develop common concepts for identification from narratives (Polkinghorne, 1995). Another type allows for themes to be "inductively derived from the data" (Kim, 2016, p. 196; Polkinghorne, 1995). The third type derives themes from the predetermined focus of the researcher's study (Kim, 2016).

The second method Kim (2016) discussed to analyze narrative data is narrative analysis. Narrative analysis emphasizes the specific happenings and events shared within the narrative data with the goal of developing a coherent plot (Polkinghorne, 1995). Interview transcripts are not simply shared as they may not embody the "significance of the lived experience in the final story" (Kim, 2016, p. 197). The developed plot is expressed through a temporally organized,

thematic narrative, or story, which increases reader appeal (Polkinghorne, 1995). To create a flowing narrative from the seemingly disconnected data points, the process of narrative smoothing is implemented (Polkinghorne, 1995; Spence, 1986). The final created narrative is true to the data while integrating, “narrative meanings that are not explicit in the data themselves (Kim, 2016, p. 198)”. Kim summarized the purpose of narrative analysis as “help[ing] the reader understand why and how things happened in the way they did, and why and how our participants acted in the way they did” (p. 197).

The researcher employed aspects of both the analysis of narratives and narrative analysis. The analysis of data collected from interviews with participants was driven by Kim’s concept of analysis of narratives. This process was accomplished through the identification and analysis of themes (Daiute, 2014). The researcher entered into the analysis process with several a priori codes. These predetermined codes were selected based on the researcher’s expectations of the data and the relevant literature. The a priori codes served as a starting point for the coding process. In conjunction with the a priori codes, the researcher was receptive to the development and emergence of indicative codes from the data (Daiute, 2014). The researcher conducted an iterative coding process. Upon completion of the coding of the data, categories were developed based on groups of codes. From within the categories, patterns present in the data were identified. Analysis of the patterns guided the researcher in the identification of themes found within the data (Kim, 2016; Spence, 1986). The identification of themes completed through the analysis of narratives was then represented in a manner in line with narrative analysis. This process will be further discussed within the Data Representation section of this text.

Data Representation

After using analysis of narratives to identify themes from the interview data, narrative analysis was implemented to create a representation of the emergent themes (Kim, 2016). The emergent themes were represented in core narratives, thus allowing for the development of story from data.

The researcher developed core narratives that were representative of six major and emergent themes identified through the analysis process. The decision to represent data through the creation of narratives was in line with Kim's description of narrative analysis (2016). The core narratives are directly created from data collected from participant interviews. The researcher collected data from participant interviews that pointed to and focused on specific identified themes. These pieces of data were organized to represent a student's temporal experience throughout their mathematics education. The researcher then wrote around the participant interview data to fill out the narrative, thereby implementing narrative smoothing (Kim, 2016; Spence, 1986). The researcher elected to present the core narratives from a first-person perspective. By representing data through first-person narratives, data are able to address the personal perspectives of the participants. The critical importance of perspective will be addressed in the discussion chapter of this dissertation. The decision to represent narratives through first-person dialogue also supported the ease of reading and increased appeal to the reader (Kim, 2016; Polkinghorne, 1995). This process resulted in six core narratives, each focusing on a singular theme that emerged from the analysis of narratives applied to the participants' interviews.

Ethics

When a researcher employs narrative inquiry in a study, certain aspects of ethics should be given particular consideration. The sharing of personal stories from the participants is a profound vulnerability that must be treated with respect. The researcher had a moral responsibility to the participants to share how their information would be used for the purposes of the research (Kim, 2016). The narrative researcher was careful not to misuse the stories that had been shared with her. Based on this process, the researcher honored the “sacredness of our participants’ humanity” (Munro Hendry, 2007, p. 496).

Two asymmetrical power dynamics existed and were addressed. The first was that of *an adult to a child*. This power dynamic could result in a number of challenges, such as the participant feeling uncomfortable sharing with the researcher or the participant attempting to respond in a way they believe the researcher is seeking. The researcher addressed both of these possibilities by building rapport and trust with the participant. It was made explicit that the researcher was interested in any and all thoughts, ideas, and stories the participant wished to share on the topics. The second power dynamic was *teacher-to-student*. This dynamic was accompanied by the same challenges as adult to child. Additionally, within the teacher-to-student dynamic, the participant may feel uncomfortable sharing critiques or negative experiences in fear it may get conveyed to their current teachers and therefore negatively affect the participant in school. The researcher explained the various ways participation was kept anonymous.

Ethics were considered for two distinct groups of participants: those who had not had the researcher as a teacher and those who had. For participants who solely attended Pacific High School and did not have the researcher as a teacher, the researcher’s district association could still be a cause for concern. To those participants, the researcher emphasized the separation

between herself and the participants' teachers and ensured the participants that no interview information would be shared with their teachers. For participants from within the Fir Program who had been taught by the researcher, safeguards were implemented. Because the researcher deemed it inappropriate to interview students that she had taught, third-party interviewers were used for those students. Participants were also assured that their participation and information shared would in no way affect their interactions with the researcher in her role as teacher.

The researcher submitted an application to the Institutional Review Board (IRB) and obtained permission to conduct the study. Humans, specifically minors, were a part of the study; therefore, the application for approval from the IRB was particularly important.

In order to maintain the privacy and anonymity of the community and participants, pseudonyms were used. The names of the community, the high school, and all participants were changed to non-identifying pseudonyms.

Physical copies of data, including interview transcripts, were handled securely. While the researcher was conducting the study, physical documents were secured in a lockbox when not in use. Digital copies of academic transcripts, interview audio recordings, and interview transcripts were securely stored on the researcher's password-protected Google Drive.

Summary

This study was approached through a qualitative lens that specifically employed narrative inquiry. Six participants were interviewed using a three-interview series. The goal of the interviews was to collect the stories of participants. Academic transcripts of participants were collected and analyzed for mathematical course progressions. Interview data were collected and transcribed. The researcher employed analysis of narratives to identify emergent themes from the data. Through the application of narrative analysis, data were represented thematically through

the creation of core narratives. The researcher approached the study ethically when collecting personal data from participants. Copies of academic transcripts and interview data were securely stored, and the anonymity of participants was maintained. The personal nature of participants sharing their experiences was treated with the utmost respect to honor their willingness to share.

Chapter 4 - Findings

Methodological Orientation

The following narratives were constructed from interview transcripts to represent participants' mathematical experiences across time. Six core narratives are included in this study. Each core narrative is an amalgamation of the experiences of multiple study participants. Core narratives are a constructed representation of an experience rather than a direct reproduction of events. Data were selected, organized, interpreted, and represented as a coherent narrative story. All aspects of core narrative development originated from the collected data. Analysis of the interview transcripts through the analysis of narratives methodology guided the researcher to emergent themes. Following the identification of emergent themes, the researcher returned to the interview data and classified experiences shared by participants in accordance with the identified themes. The experiences classified as representative of the same themes were integrated into a singular narrative, consistent with the narrative analysis methodology. Interview data were the basis for both the analysis of narrative and the narrative analysis, and thus the core narratives. Due to the rigorous reliance on the interview data in developing the core narratives, the depth and length of core narratives are responsive to the interview data. Core narratives vary significantly in length, as participants shared a widely varying number of experiences across the different specific themes. Ultimately, the researcher used participant interview data as the driving force for all parts of the core narrative creation. Core narratives are written from the first-person point of view to embody the expression of experiences and the power of personal perspectives shared by participants. Each core narrative represents a major theme from interview data. A discussion of the core narratives and cross-narrative themes is the basis of Chapter 5.

Tanya: Everyone Got It but Me

During eighth grade, Covid-19 safety protocols changed what school looked like for me. We were in a hybrid model of instruction. Although I was at school the entire week, the instruction was still predominantly through a computer screen. I only had in-person instruction for half of the school week. I hadn't felt confident with my math abilities in the past, and a year and a half of weird virtual schooling only made my apprehension and insecurity about math worse. I felt that I hadn't learned much math in 8th grade, and now I was going into the new, advanced world of Algebra 1.

My Algebra 1 experience during freshman year went as I had expected; I struggled. As I sat in class, confused and unsure of the material, I felt like my classmates' hands were flying up to answer questions that I couldn't. Although I tried to understand the new Algebra 1 concepts, I didn't understand the math from middle school that I needed to know to understand this new material.

Sometimes I asked my teacher, Mr. Murphy, for help, and he would try to help me, but the material still didn't make sense to me. I was almost constantly raising my hand asking for help. I felt incompetent. My classmates raised their hands to answer questions, but I only raised my hand to ask for help. The explanations we got in class seemed to be helpful for most of my classmates, but I was still lost. Sometimes I would ask my friends outside of class about how they were doing in math. Secretly, I was hoping that they were confused too, but my friends seemed to understand it. The kids in class made me feel alone in my confusion, and outside of class my friends just reinforced that feeling. I was confused for the rest of Algebra 1, and I failed the class.

To replace the Algebra 1 credit that I failed during my freshman year, I was enrolled in Integrated Math during my sophomore year. This class was taught by a different teacher and was supposed to be easier than Algebra 1. My Integrated Math class was smaller and moved at a slower pace. It was a better fit for me, and I passed with a C.

Instead of continuing with the Integrated Math classes, I moved back to the traditional math classes. Even though I failed Algebra 1A during my freshman year, I was enrolled in Algebra 2A for Trimester 2 sophomore year. I don't know how they expected me to do Algebra 2 when I had failed Algebra 1. Anxious and expecting to do poorly, I quickly fell behind because the material got more complex and the class went at an uncomfortably fast pace. I was really overwhelmed. I couldn't tell if other kids around me were just super smart and getting this, or if there was something wrong with me. With everyone else in the class keeping up and finishing the assignments, I felt bad about myself. Everyone could do it except for me. I came to the conclusion that the other students were capable of learning algebra, but I simply was not. Just like Algebra 1A, I failed Algebra 2A.

Now at the end of my senior year, I have had time to reflect on my experiences in Algebra 1 and Algebra 2. At the time I felt like I was the odd one out because everyone understood the material but me. I found out later that a lot of kids were like me and didn't understand it either. I wasn't the only one that was confused. I wish I would have known that then.

Samantha: No One to Turn (and Talk) to

My middle school experience was one year of virtual school and a second year of hybrid school because of Covid-19. I was generally isolated the entire time. I was either at home by myself or at school with the same small group of students. All of the Covid-19 restrictions and

guidelines were lifted at the start of my freshman year of high school. I was anxious about returning to real school. I was not only starting high school, I was going back to a normal classroom for the first time in years. The social shift between my virtual/hybrid years and a traditional classroom was challenging for me. I wasn't used to learning in an environment with so many other students. The kids who were in my grade were probably smarter than me, and the upperclassmen were terrifying. I was uncomfortable around literally everyone. On top of my social anxiety being through the roof, I had to do math, which I had always been bad at.

I enrolled in Algebra 1, the typical math course for freshmen. I struggled learning the material. I didn't like being in that classroom, period. I didn't know many people in there. To make matters worse, I felt that the other kids in that class were rude to me. I got bullied, and they would constantly laugh at me. I felt really lost and really isolated. Feeling that way made it more difficult for me to learn. I tried to ignore the negativity and get my classwork done, but it was a struggle. The teacher, Mr. Snyder, made us do activities in class that forced us to work with our classmates. A lot of the time, Mr. Snyder would tell us to turn and talk to our neighbors about a math problem. I didn't have a friend to turn to. The rest of the class was working with their neighbor, but I just sat there awkwardly alone and embarrassed. That always gave me so much anxiety. I wanted to just disappear.

I was confused a lot of the time in that class. When I needed help, I didn't feel like there was any support for me from my classmates or from Mr. Snyder. I would ask Mr. Snyder for help, but he would make us ask a classmate for help before he would help us. I was too anxious to even talk to my classmates, so there was no way I wanted to admit to them I was confused and needed their help. I couldn't get help from my peers. I couldn't get help from my teacher. I was confused and couldn't do anything about it.

Eventually, Mr. Snyder changed the seating chart, and I was relieved to be seated next to a few friends, one who was also struggling in class. I finally had someone I felt comfortable working with. When Mr. Snyder told the class to turn and talk, I could actually discuss with my neighbor without feeling anxious or embarrassed. Now that I was seated with a couple friends, together we were able to advocate for more help from Mr. Snyder. If we couldn't figure out the math problem as a group, we would take turns asking for help. I felt less embarrassed when I wasn't the person constantly asking for help from the teacher. I had a small support system, but it didn't make a significant change to my grades in that class. Having a friend to work with made the environment better, but I still didn't understand the math. I failed my freshman Algebra 1 class.

I was in Algebra 1 again my sophomore year. This time I had a different teacher and there were different kids in the class, but it was still a challenge. It was worse than the first time, honestly. I was embarrassed that I was one of the only sophomores in a class for freshmen. I couldn't hide the fact that I had failed Algebra 1 my freshman year, and now, as a sophomore, I was surrounded by freshmen I didn't even know. The few sophomores in the class always worked together. We tried to pay attention and support each other because we didn't want to fail Algebra 1 again. Unfortunately, I feel like we were all kind of lost. We didn't really know what we were doing in class, so our group collaboration wasn't super helpful. In the end, I failed Algebra 1 for the second time.

After failing Algebra 1 twice in 2 years, I needed a change. For my junior year, I transferred to the alternative education program at my high school. It was called the Fir Program. It was focused on recovering credits if you weren't on track to graduate in 4 years. The Fir Program was in a completely different building, and I only knew a couple of the other students

there. I had decided this was going to be a fresh start for me. I was committed to having a positive attitude and applying myself.

On my first day of math class in the Fir Program, I didn't know anyone. I had never met the teacher—Mrs. Hill—before or any of the other students in the class. Even though I had always struggled with social anxiety around new people, something felt different this time. I didn't feel worried about the other kids thinking I was stupid because I wasn't the only person behind. There were kids like me that might have been retaking the same course for the third time. It made me feel like I'm doing okay, I guess. Everyone in the Fir Program was trying to get back on track. I actually started participating in class. I was like, who cares? You know, we're all here for a reason. I felt comfortable asking Mrs. Hill questions because others might have the same questions as me.

I was actually able to collaborate with my classmates in that class too. I felt like I could work with anyone in the classroom and feel comfortable asking them for help. I was surprised that working together with my classmates actually did help me learn the material. It really helped being with new kids and not just being in a little echo chamber full of people that I've had past negative experiences with. I had a fresh start away from peers who had made me feel abnormal and less than others. Not only did I pass my math classes in the Fir Program, I felt confident. I didn't feel anxious about collaborating with my classmates anymore and I actually felt like I could do math.

Paul: The Social Butterfly Effect

Before high school, I had generally been successful in my math classes. When I was younger, I understood math and did well in those classes. Things changed in seventh grade. In my seventh grade math class, I was surrounded by my friends, and we liked to goof off. I didn't

understand why Mrs. Adams, my teacher, let me sit with my friends because she could clearly see we were a distraction to each other. Even though I spent time talking with my friends in that class, I still got my work done and passed. I was naturally good enough at math that I didn't have to pay that much attention to learn the math and get it done.

Two years later, I started high school and I was still a social butterfly. My first high school math class was full of my friends. We had a great time in that class; none of it had to do with math, but we messed around and had a lot of fun. My friends and I weren't the only ones who didn't pay attention; the entire class was talkative. The teacher, Mr. Belvin, did try to get the class to pay attention, but it was one against thirty. Guess who won. He wasn't going to be able to control an entire class of freshmen who wanted to be distracted. I had no interest in focusing in that class anyway because I didn't care about learning math at all. Even if I did want to learn and get the work done, it would have been completely impossible anyway because everyone in that class was wild.

Every now and then I would get motivated to lock in and get my work done. I didn't always want to be talking. That was short-lived because my friends were so distracting. I know that if my friends and I had paid attention in that class, we could have learned and completed the assignments. For the most part, we chose to be distracted by each other. I did have a couple of friends in that class who paid attention and did their work. The times that motivation struck me to get work done, I could ask those friends for help. They would have been completely willing to help me learn how to do the math. I didn't really want help learning from them, I just wanted them to give me the answers. I didn't care for an explanation of how they got the answer. I knew I could always get the answers from someone. Honestly, even if I did ask my friends to help me learn how to do the math, I knew myself; I would just end up goofing off with them instead of

taking the help, so it would have been a waste of time. Socially, I had a great time in that class. I had a blast hanging out with my friends. Mathwise, I didn't do much math at all because I was so distracted. That's why I failed my first high school math class, Algebra 1.

The next class I took was Integrated Math 1. I had friends in that class too, but they were a different group of friends than in my previous math class. These friends were at least somewhat motivated to learn, which was good because I didn't want to fail another math class. Even though my friends were still distracting, we weren't distracted 100% of the time. I could be somewhat distracted and still learn the material. When we decided to focus on learning, we worked really well together. I was good enough at math that even only paying attention sometimes, I was able to learn the material well enough to pass the class.

Junior year, I went back into the traditional math classes and took geometry. I immediately knew this class was going to be challenging for me because there were so many students in that classroom. Thirty kids in a room for a math class is not going to go well, no matter what. On top of that, I had a lot of friends in that class yet again, so that was going to be an issue. Geometry went as I expected. My friends and I were always goofing off. I had fun with my friends and made some hilarious memories, but I essentially did no schoolwork in that class. The only positives from that class were the funny times. There was not ever a moment when I was getting help or helping somebody else. I absolutely failed that class.

I enrolled in geometry again because I wanted to take physics, and I needed to pass the traditional math classes to be allowed to take that class. With my outgoing personality, it was no surprise that I had friends in that class too. Luckily, my group of friends in that class actually wanted to learn. We were juniors, and we were finally realizing we needed to get serious about earning our math credits. We didn't want to be seniors next year in underclassmen classes. I was

relieved to have friends in the class who had the same goal as me and knew we needed to buckle down and learn. In the past, my friends didn't care about learning at all. I was done being distracted and was ready to focus so I could get my schoolwork done. My friends and I actually worked together and supported each other in that class. I could talk to them but not get distracted. We were still there to learn. If one of us was confused, the others would help them, or if one of us was absent, the others would help catch them up. It was a lot better having friends who wanted to learn instead of friends who were just yapping my ear off the entire class period. Although I had promised myself I was going to focus, I hadn't become a completely different person. I still talked with my friends in class, but when I needed to, I would stop socializing and focus on learning.

I discovered that it was enjoyable not to be completely off task in class. I actually liked being able to help my friends with the math assignments. It made class more fun for me. My friends and I could still socialize and have fun, but we could calm down and pay attention when we needed to. This geometry class covered the same material as the geometry class I had just failed. Since I actually paid attention the second time, I realized it was crazy for me to have failed the first time because I could pretty easily do the math. I passed my geometry retake class, and I actually enjoyed doing the math.

Melissa: I Know That Teacher Hated Me

Middle school math was extremely frustrating for me. Not only did I have to learn new difficult material, I had to do it in a classroom where the teacher hated me. I felt that Ms. Smith, my math teacher, wasn't fair or nice. She was just evil and, honestly, a favorite picker. I am 100% sure she hated me. I was afraid of her. She was rude to me when I was confused. Ms. Smith seemed annoyed that I didn't understand what she was teaching. One specific time I

remember tears falling down my face because I was confused and Ms. Smith was annoyed with me. She was trying to explain the math over and over in the same way. I didn't understand when she explained it that way the first time, so hearing the same explanation again and again didn't help either. The other kids seemed to be getting help from Ms. Smith just fine, but I felt like she couldn't help me at all. I was positive that she hated me because she didn't even want to help me learn.

My middle school was small, so I had the same math teacher for seventh grade and eighth grade. I was stuck with Ms. Smith for a 2nd year. I didn't understand why she didn't like me. I don't know why a teacher would hate a middle school kid. She had it out for me, honestly. I didn't get the support I needed to learn because Ms. Smith disliked me. I didn't feel like I had learned much math in middle school, so I definitely didn't feel prepared to go into Algebra 1 freshman year.

I was excited about starting high school and finally getting a new math teacher. I met Mr. Graham, my freshman math teacher, and hoped he and I would get along better than I did with Ms. Smith in middle school. Once we got into the school year more, I was pretty neutral about Mr. Graham. He was a sports coach, and I was in the music programs. He was kind of a guy's guy, and I was this shy, nerdy kid. Our personalities didn't mix. He was a lot nicer to me than Ms. Smith had been, but I felt that he was rude to me sometimes. I heard that Mr. Graham had told his other students to not be like me because I didn't do enough in class. That really hurt my feelings. I knew I could do more in class, but I felt like it was inappropriate for my teacher to talk behind my back about me to other students.

Not only was Mr. Graham rude to me, it seemed like he didn't even care if I learned in his class. He would encourage me to sit next to my friend who was passing the class and take

what I needed from her on the assignments. Why would he want me to copy someone else's work instead of trying to help me learn? Clearly, he either didn't want to put the effort in to help me or he didn't believe I could do it. I had already felt self-conscious about my math skills, and Mr. Graham's opinion made me feel even worse about myself and my ability to do math.

Mr. Graham didn't take time to check in with me when I was obviously confused. If he didn't care about me, why should I care about passing his class? Now that I'm older, I know that was stupid of me, but someone should have sat me down and asked me why I was failing the class. I felt like nobody cared, so why should I care? Why did I have to care if Mr. Graham didn't care enough to check in with the students who were literally failing? I didn't keep it a secret that I didn't care about my math class, and my teacher didn't seem to care that I didn't care. If he would have actually cared about me, he would have pushed me to succeed. I ended up failing Algebra 1 my freshman year.

After freshman year, I took geometry with Mr. Graham again, so it was already off to a bad start. Things did not go well for me the last time I had him as a teacher and I assumed it would be the same this time. I did not want to be in his class again, so I talked to my academic counselor and asked to be moved out of that class. I told my counselor about my experience freshman year with Mr. Graham and asked if it was possible to be placed with a different teacher—any teacher that wasn't Mr. Graham. Luckily, my counselor was able to transfer me to a different math class with a different teacher. I was relieved that I wouldn't have Mr. Graham again, but I didn't know this new teacher at all. I was nervous to meet my new math teacher but was hoping that I would get along better with this one.

I went into my math class with a better attitude simply because I was finally away from Mr. Graham. My new math teacher, Ms. Hanson, connected with me after class to ask why I had

transferred. I explained the issues I had experienced with Mr. Graham. Ms. Hanson listened and seemed to understand my situation. She told me that she was sorry about my previous experience and that we would work together to make this course different for me. That felt really nice, and it seemed like she meant it.

As the trimester went on, I could feel a difference. I had a way better relationship with Ms. Hanson than I had with Mr. Graham. I loved Ms. Hanson. She was a likable person, very charismatic. She was always happy and enthusiastic. That made the class more enjoyable and positive. Ms. Hanson was younger too, so she could relate to some of the same television shows and music that I liked. I felt like she and I could joke together. It was pretty nice that she would sit down and talk to us. Even though it wasn't related to math, it did make me want to be in the class more. She even intentionally connected with the introverted students. There was one kid who would sit in the corner and just draw. Ms. Hanson would always tell him, "Oh, I like your drawings, they are so cool." I appreciated that she wanted to interact with everyone. Ms. Hanson actually cared about each and every student. I hadn't felt that a math teacher really cared in a while, and it changed how I approached class. I felt way more comfortable in her classroom, and I decided that I would try my hardest for her. When I felt that my teachers were being unkind to me and didn't care about me, I didn't care about that class. In Ms. Hanson's class, she cared, and I cared.

I was so used to teachers confronting me about my bad grades and telling me that I really needed to study, that having a teacher believe in me felt new. Ms. Hanson didn't treat me like I was incompetent. It was just the opposite; she treated me like I was bound for success. I knew that Ms. Hanson had seen my transcript and knew that I had done extremely poorly in my previous math classes, but that didn't seem to define her perception of me. The way she treated

me made me believe I could change for the better and be successful in math. Ms. Hanson told me that she had worked with a lot of other students who were in the same situation as me and had failed math classes in the past. She just had that vibe of “Hey, if you need help, I’m here.” That made me feel like I wasn’t so abnormal and that she would be able to help me. She would always tell me that she knew I could do it despite how I had done in the past. It made me feel like my past didn’t have to haunt me anymore. It was really cool that for the first time in a long time, I didn’t think my teacher believed I was doomed to fail another course. Ms. Hanson believed in me and that feeling encouraged me to try my hardest in class.

I had never been motivated or encouraged by a math teacher before. When I was confused, Ms. Hanson reassured me that I was capable of learning how to do the problem. Ms. Hanson would sit with me and assure me it was okay that I was confused and encourage me to not be embarrassed about it. Ms. Hanson explained to me that confusion is part of learning, and she was going to support me through the confusion until I understood. I wanted to set my standards higher for Ms. Hanson so that she would feel proud of me and proud to be my teacher. When she graded my tests, I didn’t want her to be disappointed in me. I wanted her to be excited about my progress. I was motivated to be successful and put the effort in that was required to reach my goals. I finally had a teacher who I got along with and felt like cared about me and my learning. I was able to pass my math class.

Andy: More of a Friend Than a Teacher

In middle school, math was a challenge for me. I understood some of the material but had to try extremely hard. A positive of my middle school experience was my relationships with my teachers. In eighth grade, I had a particularly great teacher, Mrs. Sparkman. She was nice, patient, and encouraged me. Mrs. Sparkman put forward a lot of effort to make sure that all of us

passed the class and actually understood the math. She could see that I needed extra help in math class. She would intentionally sit down with me in class to encourage me. Mrs. Sparkman told me that I needed to do my best because when I got to high school, I had to pass math class. She told me that in middle school, everyone moved onto the next grade, but when I got to high school that didn't automatically happen. That wasn't the most enjoyable conversation for me, but it did motivate me. I wanted to be successful in high school math, so I understood I had to start then, in middle school. I tried, but the math was challenging for me, and I knew I didn't understand it as much as my classmates did. Even though I had encouraging and motivating teachers in middle school, I still didn't feel prepared when I started Algebra 1 my freshman year. From the get-go, I didn't know if I was good enough at math to be able to do algebra.

I was relieved when I met my Algebra 1 teacher, Mr. Matthews, because I liked him. Socially, we got along great. Best buddies pretty much as far as teacher-student goes. He was a relatively young teacher, so he would join in on our jokes. He was cool, but that wasn't enough for me to not goof off whenever I could. Plus, he was chill. I appreciated his relaxed classroom vibe. He didn't really care if I passed the class or not. It was more like Mr. Matthews was a friend. He did not care if you passed unless you were a math nerd. Even when I wasn't doing well in his class, Mr. Matthews didn't give me a hard time or bother me about it. He didn't really push me to try to pass. He let me do my own thing. At the time, I thought it was nice that Mr. Matthews didn't make a big deal out of me failing, but now, I guess it was a bad thing for me. I felt Mr. Matthews was more of a friend than a teacher. His class was enjoyable because we got to hang out and relax, but he didn't do much to help me learn math.

In class, I would try to learn and take notes, but I felt like I was always behind and had been behind from the start. Even when I asked Mr. Matthews for help, I felt like he didn't really

know how to help me. He would just re-explain the concept in the same way he had just done. Hearing the same explanation a second time didn't help me. I didn't know what could have helped me learn in that class, but I knew what he was doing wasn't working. Despite his best effort to try to explain the concepts, I couldn't understand them. He didn't know how to explain it any differently. He told me to just look up videos online to get a different explanation to see if that would help me. I think he's a good person, just not a great teacher. I enjoyed having class with him, but I didn't learn much. Mr. Matthews was cool and tried to help, but he wasn't willing to have the hard conversations with me when I was failing.

My sophomore year started out just like my freshman year. I felt unprepared for my math class, but I got along with Mrs. Rush, my math teacher. She was cool, kind of like an aunt. I really clicked with her and liked her energy. Mrs. Rush was always willing to chat with us. I felt like she took the time to get to know me as an individual. She was really understanding.

I got along well with Mrs. Rush, but it was different than it had been with Mr. Matthews freshman year. She always had a positive attitude, even if she was not having a very nice day. She just stayed positive for her class. Mrs. Rush seemed to enjoy being a teacher and was enthusiastic about teaching. She wasn't just doing it for the paycheck. She was always ready to teach and push us to learn. She actually wanted to help us learn. I knew she wanted the entire class to learn, but it felt like she specifically wanted me to succeed too. I felt that Mrs. Rush was personally invested in how well I learned the material. She had a way of teaching that motivated me without making it stressful and putting a lot of pressure on me. Instead of trying to make math some intense thing, she kept it very low-key. Mrs. Rush was laid back enough that I wasn't constantly stressed about the class without being so laid back that it felt like she didn't care if I learned or not. I felt like it was the perfect balance—chill, but not too chill.

Most of Mrs. Rush's class periods started with us going through notes on a new topic and then moving on to work time. During work time, she would walk around the classroom and check on everyone individually. Mrs. Rush didn't assume that everyone understood the material. After the lesson, she would ask us, "Are you guys okay with this?" She would always work with me one-on-one if I asked for help. There would be times when I was confused and needed help but was too embarrassed to ask for it. Even if I didn't ask for help, she seemed to always realize when I needed it. I think that she would see that my paper was blank and would know that I needed help. She was always willing to help me.

I used to really struggle with being embarrassed in class. If the rest of the class was understanding the lesson, I wasn't going to raise my hand and let everyone know I was confused. Mrs. Rush knew that I would be embarrassed to constantly be raising my hand or going to her desk for help, so she would come over to me to see how I was doing all the time. She would ask me what sections I was confused on, and she would sit down and help me. Mrs. Rush would check in with me regularly. She could help me without embarrassing me. She made me feel comfortable even when I needed extra help. I feel like she knew that a lot of people might be embarrassed to ask questions because at the end of class she would always ask the class if she needed to reteach anything. She would specifically tell us not to feel embarrassed because if we were confused, she would be happy to explain it again. Even though Mrs. Rush would help me a lot, I still really struggled in that class. She invited me to the after-school study group she had, but I couldn't go. I had to get home to watch my little sibling after school. In the end, I passed that math class. I needed to get a lot of extra help from Mrs. Rush to learn the material, but I was able to do it.

Maggie: Finally, a Teacher That Could Teach

Math has been a struggle for me for pretty much my whole life. In elementary school, I started having to get extra math help. I was in a math group that got pulled out of the main classroom to get more math help. We wouldn't work on the same math that was being taught in class; we would work on stuff that was easier. I knew I needed extra math help because I really struggled with the math we were doing in class, but I don't think the math we were doing in the math group was very helpful. I knew the basics: I could add, I could subtract. That was mostly what we were doing in the math groups, so I felt like they were treating me like I was stupid. The material in the math group was too easy for me, but the material in class was way too hard. That's how math started out for me.

My middle school math experience was a mixed bag. My first middle school math teacher, Mrs. Roberts, was supportive. She respected everyone as an individual. In her class, we would do a lot of different types of activities, like group assignments, games, hands-on things, and around-the-room practices. What I remember being most helpful in Mrs. Roberts' class was how she let us retake tests if we failed them. She would pull us into a separate room and reteach us the material. She looked at our tests and knew where we were confused, so she always knew what we needed extra help with. Once we had worked with her and understood our mistakes, we were allowed to retake the test to improve our grade. Mrs. Roberts tried her hardest for us to understand the math, and with her help, I felt like I had started to learn.

In the middle of middle school my family moved, so I transferred to a new school. It was completely different from my old school. I was in remote school because of Covid. Mrs. Whalen, my new math teacher, taught extremely quickly. I know the teachers tried to keep the lessons short because we were online, but she only taught us for 20 minutes, and then she expected us to

be able to do the worksheet. It was way too fast-paced for me to be able to learn. It was quick-quick.

I was at home alone, and after a 20-minute speed lesson that taught me nothing, I couldn't do the assignment. I was afraid to ask for help at first, but eventually I caved and did. The help I could get from Mrs. Whalen through the computer wasn't useful. She would explain an extra example problem to me and assumed that was enough for me to get it. I was still completely confused. I would look up YouTube videos on the topics to try to figure it out, but those didn't help either. All the YouTube videos taught me was that I didn't even know the foundational math I needed to be able to do this new math. While we were doing fully remote learning, I didn't learn any math and I fell really far behind.

Eventually, we went to a hybrid model so we could actually be at school for at least part of the week. Returning to campus, even part-time, was stressful because I knew how far behind I was in class. I was hoping I would at least be able to start getting more help for math class, but once we got back to school, it was weird. We were in a room with one content-area teacher for the entire time and the other teachers would video-call in to teach their lessons to us. It was essentially the same as remote learning. I didn't get to interact with my math teacher like I normally would, so I still couldn't really ask questions. If I had questions, I still had to email Ms. Whalen. I never did that because I didn't even know enough about the topic to understand how to ask for help in writing. Who emails for math questions? It was so inconvenient. Even though we were there in person, I felt like Mrs. Whalen couldn't help me. I thought once we were back at school it would get better, but the way Mrs. Whalen taught still didn't work for me. I was not getting it. I was not absorbing information like I should have. It was the same as when we were online; she would quickly go through the lesson, we would take notes, and she would give us a

worksheet. I felt like Mrs. Whalen wasn't doing a teacher's job, which is to teach us. It seemed like she didn't care enough to put in the effort that a teacher should in order to help her students succeed in their class. I didn't learn much of anything in my middle school math classes.

After what felt like almost 2 years of wasted online and hybrid instruction, I was finally back in traditional classrooms for my freshman year at Pacific High School. Mr. Fox was my freshman Algebra 1 teacher. Most of the days we did the same thing in that class. The majority of the class period was note-taking. Mr. Fox would lead note-taking from the active board, and we were expected to copy down the notes. I always tried to take down all the notes he had on the board. Even though I had a notebook full of notes for that class, I didn't understand what any of them meant. Mr. Fox would basically just write down the formulas, do one example, and then move on to something else. When he did an example on the board for our notes, there wasn't much of an explanation of why he was doing each step. It seemed like he was just writing down the answers to the example problem. Honestly, even if he did give an explanation while going through the notes, it wouldn't have mattered because I was frantically trying to copy down all of the notes from the board. I couldn't absorb any instruction because I had to be focused on copying the notes down before he moved on. Later on, when I was confused, Mr. Fox would tell me to look back at my notes for help, but I couldn't make any sense out of my notes.

The pace in Algebra 1 was the worst part. I felt like the class was only for smart people. Mr. Fox moved so quickly from one section to the next. I felt like enough time wasn't spent on one thing, so I struggled to follow. Just when I would start to understand one concept a little bit, Mr. Fox immediately moved on to a different topic that went hand-in-hand with the previous one that I didn't fully understand. Everything piled on each other and as we moved forward it all

made even less sense to me. Eventually, I told myself, “I guess I’ll just wait until next term to try again.”

Once the lesson was over, we would typically have time to work on our homework for the day, which I appreciated. I tried to get as much of the work done in class as I could so I could ask questions on stuff I didn’t understand. It did seem like he tried his best to help us understand the material during our work time. He would rotate around the classroom and ask us if we needed help. Even when Mr. Fox checked in with me and tried to help me, I was still confused. He would re-explain the concept to me, but I still didn’t understand. He would try to explain it in a different way, but I still didn’t understand. I felt really bad that I couldn’t get it even after he explained it to me again. I didn’t want to take all of his time because I knew other kids needed help too. I would tell him I understood and then do my best with whatever little bit I did understand. A lot of the days I wasn’t able to finish the homework in class. If I didn’t get help from Mr. Fox during that same class period he taught the lesson, I knew I wasn’t going to be able to get help from him at all. When I had to do homework alone at home, I would usually get confused and end up using PhotoMath, which didn’t help me actually learn at all.

As the topics built on each other, the assignments got a lot more challenging for me. I tried to keep up with the work, but I was overwhelmed. I would start my assignments but not finish them because I always had a new assignment to work on. I ended up not turning in a lot of my assignments. I had a ton of missing assignments in that class, but Mr. Fox didn’t bother me about it. He didn’t really care about my homework. Freshman me loved that about him. At the end of the unit, when we had to turn in our missing work, he told me to turn in the assignments however they were. I knew the work I turned in was essentially worthless because most of the assignments were barely finished and what I did have done on them was probably wrong. I knew

I should have asked for more help before the end of the unit, but I thought he should have picked up on the fact that I was totally confused because I wasn't turning in any assignments. In other classes, when I was doing poorly the teacher would talk to me about what help I needed in order to do better, but Mr. Fox didn't do that. I was doing so poorly in his class that I felt like he knew I didn't understand the math and he didn't try to change that.

Every now and then when we were preparing for a test, we would play a team review game instead of doing a worksheet. I enjoyed the change, but it was stressful. We would be on a team with a couple other students, and we would do practice problems to get points. Now, instead of just letting myself down by not knowing how to do the math, I was going to make my partner fail too. The review game seemed like it would have been fun if I knew the material, but I didn't, and it never ended up being fun for me.

It was hard enough for me to learn the math in general, but to make it even worse, the other kids in that class were so misbehaved. Mr. Fox was laid back, so he didn't really try to control the kids in his classroom. Honestly, he was too laid back because the classroom was really loud and overwhelming all the time. Entire groups of kids in the class would be goofing off and being rambunctious. The classroom management wasn't the best in there, and I don't think Mr. Fox tried that hard to get the students under control. It was too overstimulating for me, and I would shut down. It just wasn't fun being in there.

I can't put all the blame on Mr. Fox for me failing Algebra 1. A couple times he pulled me aside and invited me to go to Wednesday study tables after school to get extra help. I couldn't stay after school because I had to get home. He offered for me to stay in his room during lunch to get help too. I don't have an excuse for not going to him during lunch, I just

didn't want to. I recognized that he tried to give me opportunities to get help, but I never took advantage of them.

The best part of Algebra 1 actually happened outside of the classroom. Since I was failing, I was forced to go to a math support class during advisory. It wasn't taught by an actual teacher, but there were seniors in there to help us. It was a peer tutor situation. The seniors would ask us what we were struggling with and help us. The help I got from the seniors in the support class was different because they would talk me through the math step-by-step, not just give me the answer to the questions. Even though the math support class with the seniors was extremely helpful, it was too little too late, and I still failed Algebra 1.

After failing Algebra 1A and getting a D in Algebra 1B my freshman year, I was enrolled in Algebra 2 at the start of my sophomore year. I was nervous about taking Algebra 2 because I hadn't done well in Algebra 1. I assumed I would need to know the material from Algebra 1 for the Algebra 2 class. However, Ms. Jorrie, my Algebra 2 teacher, refused to reteach anything from Algebra 1 because she would always say, "You should already know it."

Algebra 2 ran the same way as my previous math classes; we took notes for most of the period. I always took notes in that class, but the notes weren't particularly useful. Ms. Jorrie had horrible handwriting, so it was a 50/50 chance you were writing down the right stuff. Once, I even asked Ms. Jorrie to clarify what she had written on the board, but she couldn't understand what she had written herself. Plus, I had a hard time actually seeing the board in order to copy down the notes. My assigned seat didn't face the board, so I had to crane my neck to see. Unless people really cared about the notes, they weren't going to put in the extra effort to spin around and be uncomfortable to copy them down.

The notes moved too quickly for me anyway. I had to be so focused on trying to frantically copy down the notes from the board that I had no clue what I was actually writing. I wasn't able to think about the material at all while Ms. Jorrie was going through it. She didn't stop to ask students questions during the note-taking either. It became brainless note-taking, so I didn't want to do it. Ms. Jorrie didn't slow down for anything. If you didn't have the notes written down by the time she was ready to move on, it sucked to be you. She would say, "Okay, does everybody understand?" and then she'd look around and say, "Okay, I guess we're good" and move on to the next thing. There was a time when I did raise my hand to ask a question during the notes, but Ms. Jorrie said, "We can't talk about it right now, I'm teaching." It didn't matter that I was confused. Ms. Jorrie had a schedule that we were going to keep to no matter what.

As we got further into the trimester, the concepts built on each other. I was already confused, and now I needed to use an idea I didn't understand with a new concept that I also didn't understand. I felt like, "Dude, I can't do this." To make matters worse, sometimes Ms. Jorrie would share sidenotes about other math topics that were somewhat related to what she was teaching, but were not things we needed to know. I think it was supposed to be interesting to us, but it just confused me more. I didn't even know what I was supposed to be paying attention to. Overall, the teaching she did during the notes confused me.

Once we were done taking notes, or at least trying to take the notes, we would have 10 or 15 minutes to work on homework at the end of the period. The class assignments were all the same. There were no games or any fun in the assignments. It was just a piece of paper with problems on it. I was confused during most of the homework time. I think Ms. Jorrie assumed I would be able to do the worksheet because she had just gone over the content. She was usually at

her desk during our work time and didn't come around to check in on us. When I would take it upon myself to ask for help, Ms. Jorrie wouldn't help me herself. She'd force me to ask other kids in the class for help before she was willing to help me. I didn't think Ms. Jorrie understood how confused I was because my classmates were not going to be able to help me. After I asked a couple classmates, I could finally ask Ms. Jorrie for help. She just re-explained the concepts the same way she did during the notes. She would explain it multiple times, but it was just the same thing over and over again. I was amazed that she thought if she kept saying the same thing repeatedly, I would eventually understand it. No matter how many times Ms. Jorrie explained it to me, I could not get it. I did feel like Ms. Jorrie wanted me to understand, but her explanation didn't help. After seeing I still didn't understand, she told me to look through the notes slides again and watch a YouTube tutorial video. I was confused about the math and didn't understand how to do the assignments, so my unfinished homework piled up. I asked for extensions, but Ms. Jorrie said "Well, that's too bad, no. Turn them in as they are or don't turn them in. You don't really have to do them anyway." I just felt really unsupported and like she had given up on me.

The other kids in that class made it even harder for me to learn. Ms. Jorrie couldn't control the students. She had really poor classroom management. The students were loud during the entire class period, even when Ms. Jorrie was trying to talk. I felt like she didn't care enough to even try to get the class to quiet down while she was teaching. She would keep teaching even if only three kids were actually paying attention and everyone else was sleeping, on their phones, or goofing off. It was total tomfoolery, or whatever you want to call it. There's no reason I should be laughing for 10 to 15 minutes over a TikTok video at full volume that the whole class could hear. She just tried to talk over the loud teenagers. It seemed like she just wanted to teach math without actually teaching us. It was really hard to focus. I failed that Algebra 2 math class.

After Algebra 1 and 2, I was discouraged because I had done poorly in all of my high school math classes so far. Next, I was enrolled in Integrated Math. I had heard that it was considerably different from the other traditional math courses I had taken. Mr. Browne, my teacher, re-taught stuff from other classes that all of us failed but he would teach it at a slower pace. Right away, there was one clear difference between my algebra classes and my new Integrated Math class. This class was way smaller. My algebra classes had around 30 students, but this one only had about 10 students. Since it was so small, it was more one-on-one with the teacher. Because there were so few of us, everyone could sit and face the front of the room. I appreciated being able to easily see the board.

Although I didn't feel prepared at the start, Mr. Browne's course started with a review of the material we needed to know for the class. The first unit was all review. I felt relieved because I could do this math, and it felt nice, even if it was only the review unit.

The classroom environment was different too. Mr. Browne actually had control of the classroom. I felt much calmer in his class. He would get the class's attention before he began the lesson, so everyone knew it was time to pay attention. Otherwise, what's the point of even trying to start? He made more of an effort to get the kids to shut up and ensured our phones were away. It was quiet in the room other than the teacher's lesson, which made it easier for me to focus on notes. That's not to say the entire class period was completely silent. We were still able to joke and laugh, but we knew when it was time to quiet down and focus.

Mr. Browne's class was normal in the sense that most days were made up of notes and work time, but every day we did a warm-up too. At the start of each class period, Mr. Browne had a warm-up on the board for us. It was usually one or two questions that reviewed the material we covered the day before. It helped me to have time to settle in and get back into it the

next day. It was a good start to every class and got me engaged right away. Once everyone finished the warm-up, we would review how to solve it and then answer as a class. I feel like warm-ups really helped me to get started for the day.

After the warm-up, Mr. Browne would go over things or introduce new topics with notes. There were kids at a lot of different levels of math understanding in that class, so he would go over the notes slow-ish, so everyone could get it. Mr. Browne made us keep our notes really organized. We had to keep everything in a specific order in a classroom binder, so it was easy to keep track of. The actual notes were different than they had been in other math classes. He would give us a printed-out notes page. We still had to copy things down from the board, but some of the notes were already written for us. I was able to listen more during the lesson instead of focusing on copying down every single thing the teacher was writing. While we went through the notes, Mr. Browne explained the concepts in simple terms and taught us how to do the problems step-by-step. He didn't make it feel like a big scary thing to do. It was more relaxed and direct. Once we understood the basics, he would start slowly introducing more stuff, stacking it. I could actually understand the reasoning because I was able to see the ordered steps in the notes. I feel like he made it all seem really simple even if it was something that wasn't simple at all. Mr. Browne would walk around while he was teaching through the notes to make sure everyone was actively copying the notes; he wouldn't just stand up at the board. If he noticed someone was having a hard time keeping up with the note-taking, he would give us more time to catch up. He would also stop during the notes to ask us questions about what we were learning. That helped a lot, and it was really refreshing to have someone actually make sure that I knew what was happening before we moved on. The notes always included examples too. I appreciated being able to try a problem as a group before I was on my own for homework. We would talk through

how to solve them as a class. Sometimes Mr. Browne would call on a student to complete the problem on the board. At the start, I really hated that, but as the trimester went on, I ended up liking it. I was always nervous I would get picked to do the problem, but it helped me stay engaged during the notes. I wanted to make sure I was ready in case I did get picked to do it. Having said that, it wasn't a big deal if anyone was confused when he called on them because he would let another classmate help out. The majority of the time, the students were the ones explaining how to solve the problems. Hearing the other students explain the problems helped me. I liked it being explained to me in different ways by different people. The entire notes process was helpful, and it made learning math a lot easier.

After the notes and class examples, Mr. Browne had time for us to work on the homework assignment. We had a good amount of time to work on our assignment and get help, so I felt less rushed. Sometimes I would work with my classmates to figure out the problems. If we couldn't figure it out together, the teacher was always available to help during the work time. Although homework wasn't my favorite thing, it did help me learn in that class because practice makes perfect. The assignments were a hassle, but it worked for me and I enjoyed it.

Even though most of the class periods were warm-up, notes, and homework, sometimes we would do different activities. Mr. Browne made it fun. Some days we would play Kahoots or team games to practice instead of just writing on a paper. I liked the team activities because I could get help from my classmates. Other days we would do around-the-room activities to practice. I enjoyed getting out of my seat instead of sitting all day. I appreciated that Mr. Browne didn't give us a worksheet every single day.

A game-changer for me was how much help I could get from Mr. Browne while we worked on our assignments during class. He was so supportive. He didn't just leave you on your

own to figure stuff out. Mr. Browne would float around the class and ask us if we needed help. He asked us individually if we needed help, so I didn't have to feel embarrassed about constantly going to his desk or raising my hand. In the past, if the majority of the class understood, I wasn't going to embarrass myself by saying, "Hey, I don't understand." Even if I didn't actually ask for help, he could usually tell when I needed it, and he would come over. I felt much more comfortable getting help from Mr. Browne than I had with my other math teachers. He was patient with me and never seemed annoyed by my questions.

When Mr. Browne helped me, he was able to explain the material in different ways that made more sense to me. Sometimes he would use new examples to reframe the concept for me, and it helped me to get a better grasp on the material. He would explain the *whys* behind the concepts and formulas, which helped me make connections, so it didn't feel so random. I felt like I finally had a teacher that could explain the ideas in a way that made sense to me.

Regularly throughout the trimester, Mr. Browne would ask the students for feedback on the class. That was huge for me because he actually listened to us. He would ask us what he could do better or what other things we needed from him to be successful. He actually followed through on some of our suggestions. I felt that Mr. Browne was willing to put the effort in to help us learn.

I also liked how Mr. Browne handled testing. If I, or anyone else, failed a test, we were allowed to retake it. We did test corrections on the specific questions we got wrong. If the entire class did poorly on a section of the test, he would spend time reteaching that specific section. That helped me understand the mistakes I had made on the test. After we did the corrections and showed him we had learned from our mistakes, we were allowed to retake the test. Even though it was more work, it was helpful that we had to make corrections before doing the retake because

otherwise you're just retaking it, not knowing what you did wrong. If I did poorly on a test, it wasn't the end of the world. Mr. Browne would still help me improve on the topics I was struggling with and I could try again.

Overall, this integrated math class was moving at a pace that was more aligned with me. The slower pace definitely helped. Mr. Browne took his time and didn't seem to be in a rush to get through the material. He gave us a lot of refreshers and taught in a way that I didn't feel left behind. Mr. Browne didn't move ahead until we were ready. I felt like he was more concerned about us learning than sticking to the schedule. At the end of each period, Mr. Browne would ask us how we were feeling about the material. He made sure we knew that there was no embarrassment in needing him to reteach something. He always said, "If you do need to relearn it, I will always reteach it." I finally got a good teacher who knew how to teach kids that needed a little bit of a slower pace. It made math a lot better. It just started clicking because of the slower pace, and I started feeling confident in class. For the first time in a long time, I felt like I was finding success in math class. Mr. Browne really drove home the idea that I could actually do it. My success was 100% Mr. Browne. I love Mr. Browne so much because that was the first time I felt like math was okay. I even wanted to go home and study because I was doing so well, and it felt great.

Throughout the trimester, I could feel the difference between this math class and my previous ones. I felt that Mr. Browne not only wanted to help me learn, but that he actually had the ability to help me learn. I finally passed my math class, and it felt pretty nice.

Conclusion

Taken together, these six core narratives represent patterns in participants' experiences of failing Algebra 1 and navigating subsequent mathematics coursework. Although each narrative

centers on a distinct aspect of those experiences, the narratives also reveal connections across participants' perceptions, relationships, engagement, and experiences of mathematics learning. Chapter 5 considers these patterns in relation to the study's research questions, theoretical framework, and relevant literature.

Chapter 5 - Discussion

Outline of Discussion

In this chapter, a discussion of the findings described in the six core narratives is presented. A brief summary of each core narrative is provided followed by a discussion of within-narrative themes. The emergent themes discussed are peer comparison, belongingness, social norms, student-teacher relationship, teacher commitment, and student-responsive instruction. Following the discussion of the individual core narratives, themes across core narratives are presented. These themes include the power of engagement and the power of perception. Next, the study's research question and subquestions are addressed. Finally, recommendations for future research are presented.

Tanya

Tanya's Summary

Tanya's story serves as an example of how peer comparison can be impactful. Throughout her algebra courses, Tanya consistently believed that her classmates understood all of the material and were passing their assessments. She felt self-conscious that she required significantly more help from the teacher than her peers. She concluded that she was not capable of learning algebra. Ultimately, her perception of her position among her peers was inaccurate as many of them also struggled through the course. At the time, Tanya felt incompetent, isolated, and embarrassed because of her confusion, but in reality, she was surrounded by peers who were experiencing similar challenges.

Tanya's Discussion—The Power of Peer Comparison

Tanya's story emphasizes the power of peer comparison. The discussion of this theme addresses self-doubt, self-identity, and misperceptions. Tanya's critical turning point from self-

doubt and negative self-identity occurred at the conclusion of her high school tenure after gaining insight into the inaccuracies of her own perception.

The feeling of self-doubt was created through, and fostered by, her lack of mathematical understanding. Tanya began her high school mathematics courses aware she lacked foundational knowledge. She identified her insufficient prior understanding as a contributing factor to her continued struggle to learn. Tanya's perception that her insufficient prior knowledge contributed to her persistent struggle to learn is congruent with Tomlinson and Sousa (2020) and Fernández and Morris's (2018) assertion that neurologically, prior knowledge impacts the development of new knowledge. Tanya's insufficient prior mathematical knowledge set her up for increased challenges in learning new material.

Her awareness of her deficiency in foundational knowledge likely contributed to the emergence of her self-doubt. Tanya's feeling of self-doubt was the beginning of a negative mathematical progression, illustrating Heyd-Metzuyanim's (2015) assertion that emotions are a part of developing routes to failure. Her negative emotions were likely a contributing factor to her academic struggle to learn mathematics because there exists a connection between emotions and learning (Boaler & Dieckmann, 2026; Chen et al., 2018; Desautels, 2016; Tomlinson & Sousa, 2020).

Self-doubt led to constant comparison between herself and her peers. Due to Tanya's awareness of her lagging skills and self-doubt, she used her peers' performance as a measure of her own performance. Since she was not successfully participating and learning in class, but her peers seemingly were, she characterized herself as abnormal.

Tanya's repeated comparisons with her classmates gradually transformed uncertainty into a belief that success was unattainable. Once she accepted this belief, her academic performance

likely reflected not only gaps in mathematical understanding but also diminished confidence in her ability to improve. Bandura and Locke (2003) similarly argued that low self-efficacy can suppress performance below an individual's actual capability.

An important shift occurred when Tanya stopped viewing failure as something she experienced and instead viewed it as evidence of who she was. By interpreting repeated struggles as proof of limited innate ability, mathematics became an issue of identity rather than one of learning. Bandura (1989) described this attributional pattern among individuals with low self-efficacy, who frequently explain failure as the result of insufficient natural ability. Rather than interpreting difficulty as an opportunity for growth, Tanya interpreted every unsuccessful experience as confirmation that she lacked the ability to succeed. Each new struggle reinforced the conclusions drawn from previous failures, making future effort seem increasingly futile. This pattern reflects the characteristics of low self-efficacy described by Bandura et al. (1996) and a fixed mindset described by Dweck and Yeager (2019). Tanya was in a low self-efficacy and fixed mindset loop. Her disbelief in her ability to improve resulted in the development of a fixed mindset, which further solidified her low self-efficacy. Schunk and Pajares (2009) similarly highlighted the reinforcing relationship between self-efficacy and mindset. Tanya resigned herself to inaction and failure, feeling her effort would not produce results.

Embracing a negative self-identity affected how Tanya approached mathematics in general. The development of a personal identity as someone who was incapable of doing algebra stayed with Tanya through the remainder of her high school experience. Tanya's self-identity as someone incapable of doing algebra existed in contrast to Boaler's (2016) assertion that no one is born without the ability to learn math. At a later point in time, Tanya discovered that many of the peers she perceived as successful in class had also been feeling confused and incapable.

Although Tanya's interpretation of the situation did not fully reflect reality, it nevertheless shaped how she understood herself as a mathematics learner. Regardless of its accuracy, her perception influenced her beliefs, behaviors, and subsequent experiences, illustrating Bronfenbrenner (1977) and Thomas and Thomas's (1928) argument that perceived reality can have powerful consequences. This misperception likely had an impact on Tanya's cognitive ability to learn new mathematics since it is congruent with Tomlinson and Sousa's (2020) assertion that an individual's perception of their environment affects brain functioning. The narrative she developed about herself and her mathematical experiences could have had vastly different outcomes if her self-doubt-driven comparison to her peers was different.

Tanya's narrative suggests that peer comparison can impact an individual's identity. Her experiences indicate that self-doubt created by insufficient prior knowledge led students to compare their abilities to their peers'. An identity of mathematical inability was developed by peer comparison and repeated failure. Regardless of the accuracy of the comparison, it impacted student perception of self and had lived consequences. Together, these findings suggest that the way one perceives one's self in comparison to peers has implications on identity development.

Samantha

Samantha's Summary

Samantha's story serves as an example of how peer acceptance can be impactful. Samantha's story juxtaposes the stark difference between negative and positive social environments within a classroom. During the first 2 years of high school, Samantha experienced negative social interaction in the classroom that included bullying and embarrassment. She felt isolated and alone in her mathematics classes. She did not have peers to collaborate with, and her pre-existing negative relationships with classmates contributed to her struggle to fully participate

in class and ultimately led to her failure to grasp the material. During the last 2 years of high school, Samantha was surrounded by peers who were in the same position as her academically and more accepting of her. Samantha was more comfortable in the classroom. She felt confident collaborating with her classmates. Being among peers who were accepting, supportive, and in a similar situation coincided with full participation in learning experiences.

Samantha's Discussion—The Power of Belongingness

Samantha's story embodies the theme of belongingness. The discussion of this theme addresses pre-existing peer relationships and similarly situated peers. Samantha's critical turning point occurred when she transitioned from a classroom in which she did not feel accepted to a classroom in which she felt a kinship with her peers.

Samantha's experience of lacking a sense of belonging occurred in a small, rural community that was defined by a familiarity with her peers and a continuity of relationships from school year to school year. Although some may infer this to be a strength for students, Samantha's experience indicated it was a weakness and a hindrance to progress. For Samantha, the continuity was characterized by previously established negative peer relationships. Those pre-existing relationships influenced how Samantha felt about herself and her current peers and contributed to a persistent negative perception of her classroom relationships. She felt that her peers created an unsafe and uncomfortable learning environment. Rather than focusing on learning, Samantha was concerned with how her peers would perceive and treat her. She could not pursue the help she needed in class for concern that it would expose her to the negative perceptions and actions of her peers. If her peers were aware that she did not understand the material and was unable to complete assignments, she feared she would be further ostracized and the recipient of their scorn.

Samantha's narrative suggests that her greatest obstacle was not simply difficulty with mathematics but difficulty with the social environment in which learning occurred. Because she anticipated ridicule from her classmates, academic vulnerability became socially risky. Asking questions, admitting confusion, or requesting help carried interpersonal consequences, thus making self-protection a higher priority than learning. Bronfenbrenner (1975) and Crawford (2020) similarly emphasized the importance of social contexts in shaping individual development. The negative emotions Samantha felt due to her peer relationships likely contributed to negative learning outcomes in light of the significant connection between emotions and learning (Boaler & Dieckmann, 2026; Chen et al., 2018; Tomlinson & Sousa, 2020). Samantha's descriptions suggest that cognitive resources were redirected away from learning and toward managing potential social threats. Rather than concentrating on mathematical ideas, she monitored how her classmates might respond if she revealed confusion or asked for help. From this perspective, the classroom became a place where protecting herself socially took precedence over engaging academically. Research on learning and neuroscience provides a possible explanation for this pattern by showing that perceived threats can interfere with cognitive processing (Desautels, 2016; Tomlinson & Sousa, 2020). A hostile peer environment minimized the ability for safe academic pursuits.

The transition to the Fir Program did more than place Samantha in a different classroom; it changed the conditions under which she participated in mathematics. Without the burden of long-standing negative peer relationships, she no longer had to anticipate ridicule before deciding whether to engage. The absence of those expectations created opportunities to participate that had previously felt inaccessible. Bronfenbrenner (1979) described this type of ecological transition as one capable of reshaping individuals' interactions with their

environments. This classroom defined by acceptance and support contributed to Samantha's positive emotions and ability to learn (Tomlinson & Sousa, 2020). Simply put, without the presence of pre-existing negative relationships with peers, negative emotions lessened.

Peers situated in similar academic positions supported academic freedom. In the Fir Program, Samantha was in a community of students who had experienced academic struggles. There was no hierarchy in which those who were confused or behind were thought of as less than others because everyone's situation was similar. All of her peers had struggled in their previous mathematics classes, and many of them were also upperclassmen still in traditionally underclassman courses. Her integration into her new community was powerful and significantly impacted her, thus supporting Bronfenbrenner's (1975) assertion that societal integration is critical for development. Samantha's peer environment served as a social safety net providing emotional safety in the classroom. Emotional safety is a critical support to neuroplasticity, as it reinforces the ability to take academic risks, build resilience, and, thus, learn (Goldberg, 2022; Kolb & Gibb, 2011; Petrosini et al., 2009). If Samantha expressed confusion or required help, she was not an oddity. It was the norm to require additional help. Samantha's experiences in the Fir Program were a stark contrast to Heyd-Metzuyanim's (2015) idea of ritual participation, in which students are expected to display mathematical competence by producing correct answers, often without genuine understanding. In this new environment, Samantha was in a community where expressing confusion was socially acceptable as part of the process toward true understanding. The freedom to learn without fear of social consequences supported academic freedom.

Samantha's narrative suggests that belongingness was not simply an emotional benefit but a prerequisite for meaningful engagement in mathematics. Her experiences indicate that

students are unlikely to take the intellectual risks necessary for learning when they anticipate negative social consequences. Once those consequences are removed through a community of similarly situated peers and the absence of hostile relationships, participation becomes safer, confusion becomes acceptable, and learning becomes possible. Together, these findings suggest that belongingness shapes mathematics learning not only through students' feelings of acceptance but also through the degree of academic risk they perceive they can safely take.

Paul

Paul's Summary

Paul's story serves as an example of how peer groups can be impactful. All of Paul's experiences in mathematics class could be described as positive from a social perspective. He had friends who he enjoyed socializing with during class time. However, the manner in which Paul's academic experience was affected by those friends differed. At times his friends were detrimental to his learning, and at other times they were beneficial to his learning. If Paul's friends were not concerned about learning the material, he too was not concerned with learning the material. If his friends were diligent in class, he too was diligent in class. Paul's commitment to his learning was subject to his friends' level of commitment to learning.

Paul's Discussion—The Power of Social Norms

Paul's story embodies the theme of social norms. Discussion on this theme addresses social risk and both the positive and negative effects of social norms. Paul's critical turning point occurred when he transitioned from peer groups focused on socialization to peer groups focused on passing their mathematics class. Paul's story does not have a singular turning point since he was responsive to the norms of his changing peer group throughout his educational journey.

Many times, educators desire students to learn their lesson and not repeat their mistakes. Paul's journey was more cyclical in nature.

Paul's narrative suggests that students do not make academic decisions in isolation. Instead, classroom behaviors were shaped by the unspoken expectations of the peer groups to which he belonged. These social norms influenced what behaviors were viewed as acceptable, what behaviors carried social consequences, and ultimately whether learning or socializing became the group's shared priority, thereby demonstrating the influence interactions have on an individual's experience (Bronfenbrenner, 1994; El Zaatari & Maalouf, 2022; Tong & An, 2024). Paul's story also illustrates that peer norms were not simply imposed upon him. By adopting the behaviors valued within each group, he simultaneously reinforced those expectations for others. His participation helped sustain the very classroom culture that influenced his own behavior, reflecting the reciprocal relationship between individuals and their environments described by Bronfenbrenner and Ceci (1994). Two distinct educational outcomes emerged from the different accepted social norms experienced by Paul: (1) the outcome of a peer group unfocused on learning, and (2) the outcome of a peer group focused on learning.

In examining Paul's experience within a peer group focused on socializing rather than learning, it can be noted that Paul's difficulties did not appear to stem from an inability to understand mathematics. Instead, they reflected the social costs associated with violating group expectations. Participating academically would have required separating himself from peers whose shared norms emphasized socializing over learning. Remaining aligned with the group therefore became more valuable than engaging fully with the mathematics. Heyd-Metzuyanim (2015) similarly argued that classroom social norms can contribute to students' mathematical success or failure.

However, in examining Paul's experience within a peer group focused on learning, the powerful positive effect social norms can have on educational outcomes can be seen. When in a social group that had social norms emphasizing learning, again, Paul abided by the social norms of his peer group. Refusing to participate in learning would have created separation between himself and his social group. The social motivation to remain aligned with the group had positive academic results when group social norms emphasized learning. Understanding was not the primary factor of Paul's academic struggles or successes in his mathematics courses; rather, it was his inclination to stay in line with the social norms of his in-class peer group. The accepted social norms within classroom peer groups can have educational repercussions, both negative and positive. Paul's unique experience with peer groups both supporting and hindering his educational outcomes provides both support and dissonance to Goldberg's (2022) claim that social safety nets support academic outcomes. In both contexts, Paul had a social safety net with a solid group of peers, but the benefits of his social safety net were only realized when the peer group's social norms included learning.

Paul's narrative suggests that peer groups influence learning less through their existence than through the behaviors they reward. Paul demonstrated markedly different academic outcomes as the norms of his peer groups changed across classrooms. These findings indicate that social norms shape mathematics learning by defining which behaviors are socially acceptable and which require interpersonal risk. Consequently, students' decisions to engage or disengage may reflect attempts to maintain group membership as much as they reflect motivation or mathematical ability.

Melissa

Melissa's Summary

Melissa's story serves as an example of how a positive relationship between teacher and student can be impactful. Throughout Melissa's middle school mathematics and Algebra 1 experiences, the interactions she had with her teachers were marked by disconnection and discouragement. Those interactions contributed to her disinterest in mathematics and her belief that she lacked the ability to learn mathematics. A sharp transition to a different relationship with a different teacher appeared to be a catalyst for Melissa's transformed view of her ability to do mathematics and a positive shift in her motivation. After Algebra 1, Melissa's teacher expressed care for her individual needs and a belief in her capabilities, which seemed to foster increased motivation and learning.

Melissa's Discussion—The Power of the Student-Teacher Relationship

Melissa's story embodies the theme of student-teacher relationship. The discussion on this theme addresses trust, reciprocity of relationships, and motivation. Melissa's critical turning point occurred when she transitioned from a teacher who did not have a caring relationship with her to a teacher who prioritized fostering positive relationships with students.

Melissa's negative experiences with mathematics teachers must first be addressed. Melissa shared the impact of a teacher speaking negatively about her to other students. This negative experience broke the innate trust that is assumed between a teacher and a student. Once trust was broken, Melissa no longer interpreted her teacher's actions at face value. Instead, every subsequent interaction was filtered through the expectation that her teacher neither valued nor believed in her. The initial breach of trust extended beyond a single incident and reshaped the meaning of future interactions. This pattern was evident when, rather than helping Melissa

understand the mathematics, her teacher encouraged her to obtain answers from her peers. Melissa interpreted this response as communicating that producing completed work was more important than developing understanding and that her teacher did not believe she was capable of learning the material herself. Rather than viewing this interaction as instructional support, she experienced it as further confirmation that her teacher had little confidence in her potential. This interaction reflects Heyd-Metzuyanim's (2015) description of ritual participation, in which demonstrating acceptable mathematical performance can become more important than fostering genuine mathematical understanding.

Melissa interpreted her teacher's actions as evidence that he had little confidence in her ability to learn mathematics, thereby reflecting a fixed mindset in beliefs about Melissa's academic ability (Dweck & Yeager, 2019). The existence of the teacher's apparent fixed mindset about Melissa's ability affected the way she perceived her teacher and her teacher's actions. The negative emotions felt by Melissa as a result of these negative interactions with her teacher could have had a direct effect on her learning because the relationship between emotions and learning is well documented in prior literature (Boaler & Dieckmann, 2026; Chen et al., 2018; Desautels, 2016; Tomlinson & Sousa, 2020). Negative interactions between teacher and student break trust, and broken trust affects perceptions of subsequent interactions.

Socially, Melissa perceived the poor personal connection with her teacher as a lack of care about her as a person. Academically, her teacher did not conduct individualized check-ins, reinforcing Melissa's belief that her teacher did not care about her learning. Melissa's negative relationship with her teacher contributed to her lack of academic care. Melissa's response suggests that caring within the classroom was reciprocal rather than one-sided. As she became increasingly convinced that her teacher was indifferent to her success, she gradually withdrew

her own emotional investment in the class. The relationship deteriorated as Melissa's perceived lack of care from her teacher was met with an equally diminished investment in the class. This reciprocal pattern is consistent with Bronfenbrenner's (1979) view that development is shaped through ongoing interactions within relationships.

In contrast, a positive student-teacher relationship fosters student commitment and motivation. Melissa experienced a teacher who built a bridge of trust by seeking connection, both socially and academically. The positive relationships created by this teacher supported emotional and social safety within the classroom. Goldberg (2022), Kolb and Gibb (2011), and Petrosini et al. (2009) similarly identified a connection between safety and learning. The positive emotions associated with Melissa's relationship with her teacher likely contributed to increasingly positive learning outcomes (Tomlinson & Sousa, 2020). Perhaps the most significant change was not that Melissa suddenly became more capable in mathematics, but that someone else consistently communicated that she already possessed the capacity to succeed. Her teacher's confidence provided an alternative narrative to the one Melissa had developed about herself. As Melissa gradually accepted this new narrative, her willingness to engage, persist, and invest effort also changed.

Melissa experienced her teacher's words and actions as consistently communicating that her mathematical ability could grow with support and effort. Those interactions reflected principles associated with a growth mindset (Dweck & Yeager, 2019) and appeared to influence Melissa's own beliefs about what she could accomplish. Her teacher's reassurance increased her own self-belief and motivation to learn. Melissa's academic shift motivated by her newly developed self-efficacy illustrates Bandura's discussion on the positive impact of self-efficacy. Melissa believed her ability could be developed, she put forward more effort, and she persisted

through academic challenges. A positive student-teacher relationship characterized by belief in and care for the student increased student motivation and effort.

Melissa's narrative suggests that student-teacher relationships influence learning through the development of trust, communicated belief, and reciprocal investment. When trust was broken, Melissa interpreted subsequent interactions through a lens of skepticism and gradually disengaged from the class. In contrast, when a teacher consistently communicated care and confidence in her ability to succeed, Melissa became increasingly motivated to invest effort, persist through challenges, and engage in learning. Together, these experiences suggest that teacher relationships shape not only students' emotions but also how they interpret classroom experiences and their willingness to participate in them.

Andy

Andy's Summary

Andy's story serves as an example of how a teacher's commitment to student learning can be impactful. Andy consistently had mathematics teachers he connected with socially. In Algebra 1, despite the positive relationship with his teachers, he did not learn the material, and his teacher did not push him to learn. The positive relationship was not sufficient to foster learning. Andy's later experiences in mathematics classes were characterized by a teacher who expressed commitment to his learning and pushed him to learn.

Andy's Discussion—The Power of Teacher Commitment

Andy's story embodies the theme of teacher commitment. This discussion explores how academic expectations, instructional practices, and teachers' communicated belief in students shaped his mathematical experiences. Andy's critical turning point occurred when he transitioned from a teacher who allowed him to disengage from learning to one who consistently

expected and supported his academic success. Throughout his schooling, Andy described having positive social relationships with his mathematics teachers. He felt that his teachers cared about him as a person, intentionally built rapport, and took an interest in students' lives outside of mathematics. However, Andy's experiences suggest that positive relationships alone were insufficient to promote learning. Although his teacher fostered a comfortable classroom environment, low academic expectations and a willingness to allow students to disengage communicated a lack of instructional urgency. Failing was not treated as an issue requiring immediate attention, and academic support was limited. As a result, the relationship provided social comfort but little academic challenge, thus suggesting that maintaining positive rapport had become a greater priority than ensuring students' mathematical growth. This distinction aligns with Bronfenbrenner's (1979) emphasis on the importance of developmental relationships in supporting individual growth. Maintaining a positive social relationship took precedence over holding students to academic standards.

While Andy did receive academic support from his teacher, it proved to be ineffective in supporting his understanding. Despite the desire to help, Andy's teacher did not have the instructional methods and tools to support struggling learners. An inability to reframe ideas and a teaching style that asserted a singular method of solving provided ineffective support for Andy. The perceived incongruency between the teacher's desire and ability to provide student support suggests that positive teacher intent does not outweigh ineffective instructional strategies.

Andy's mathematics experience changed after transitioning between teachers. A positive social relationship was consistent, but there existed a stark difference in Andy's perception of how his teacher approached teaching. Andy perceived his new teacher's central purpose in the classroom was to support student learning, as evidenced by her instructional choices. Her

instructional decisions consistently communicated that every student was expected to learn and that she would provide the support necessary to help them succeed. This process included her development of a low-stress, high-support classroom. This type of classroom environment aligns with research suggesting that emotional safety promotes mathematical problem-solving and supports the neuroplasticity associated with learning (Eynde, 2006; Goldberg, 2022; Kolb & Gibb, 2011; Petrosini et al., 2009).

Rather than lowering academic expectations, Andy's teacher reduced unnecessary barriers to learning, such as anxiety and embarrassment. She tempered classroom stress through supplying needed help and intentionally erasing embarrassment associated with requiring help. She provided high support by being aware of the different levels of understanding within the classroom and giving aid, whether requested by the student or not. This classroom reality reflects Ojose's (2008) observation that not all students within a singular classroom will be in the same stage of understanding. The teacher left no option for a silent opt-out by students because she expected all students to learn. Students were required to actively participate in the learning process; this necessity of participation is supported by Goldberg's (2022) discussion on the requirement of active participation by students for neural pathway development. The teacher was vigilant regarding student understanding and confusion. Her help was present and thrust upon the student whenever she recognized the need. Rather than providing identical support to every student, the teacher adjusted her instruction to students' demonstrated needs. By responding to individual levels of understanding, she maintained high expectations while providing the assistance necessary for students to be successful. This responsiveness reflects principles associated with the zone of proximal development (Bozkurt, 2017), in which learning is maximized when instruction is matched to students' current level of development.

By providing support that was responsive to students' individual levels of understanding, Andy's teacher created conditions in which students could engage with challenging mathematics without becoming overwhelmed. The educational outcomes of responsive instruction are supported by neuroplasticity research on the positive impact the zone of proximal development has on student experience (Baars & Wijnia, 2018; Goldberg, 2022; Tomlinson & Sousa, 2020). The teacher cared enough about her students as individuals to push them to succeed. Andy's teacher's classroom embodied her belief that all students were capable of being—and were expected to be—successful. Andy interpreted these actions as evidence that his teacher believed in her students' ability to grow and improve, reflecting principles associated with a growth mindset (Dweck & Yeager, 2019). A positive student-teacher relationship in conjunction with the teacher's belief in students, high expectations of students, and insistence on providing support to students fostered student involvement.

Andy's experiences demonstrate that positive student-teacher relationships and teacher commitment are not synonymous. Although both teachers established caring relationships with students, only one paired those relationships with high expectations, effective instructional support, and a persistent belief in students' ability to learn. Andy's narrative suggests that meaningful engagement emerged when relational support and academic commitment worked together.

Maggie

Maggie's Summary

Maggie's story serves as an example of how effective instructional strategies can be impactful. Throughout her educational experiences, Maggie struggled to grasp mathematical concepts taught in class. She felt her teachers were not creating a class period that allowed her,

or motivated her, to learn. This experience resulted in Maggie eventually resigning to failure and deciding she would try again the following year. Following multiple failed high school mathematics courses, her experience changed. She was in a class with a teacher who created a classroom responsive to her needs with appropriate support structures. Maggie found success and motivation while in a classroom with a teacher who had the instructional means and care to support her unique needs. Maggie did not want to disappoint her teacher and was motivated to do well for her.

Maggie's Discussion—The Power of Student-Responsive Instruction

Maggie's story embodies the theme of student-responsive instruction. This discussion explores the tension between a commitment to material coverage and a commitment to student learning. Maggie's critical turning point occurred when she transitioned from a teacher who prioritized covering the curriculum to one who prioritized students' understanding. Maggie's experience in her initial algebra course was characterized by rapid, teacher-directed instruction that left little opportunity for meaningful engagement.

While her teacher was well-versed in the subject matter and was able to explain the concepts, Maggie's experiences suggest that effective instruction requires more than accurate presentation of material and that the teacher did not consider the impact of cognitive load on the student's ability to learn. Instruction was seemingly focused on covering the required material for the day, with the predetermined schedule dictating all other aspects of instruction. Therefore, Maggie's perception of instruction was characterized by the constant addition of new material, with no consideration of student processing. Research on cognitive load similarly suggests that instruction must account for students' capacity to process new information in order to support learning (Gupta & Zheng, 2020). Although the parts of an effective classroom were present, they

seemingly were not implemented in a way that resulted in an effective learning environment as a whole. Teaching was occurring, but learning was not. Maggie's experiences suggest that the teacher's primary commitment was to covering the curriculum rather than ensuring students learned it.

Maggie's experience shifted when she entered a classroom in which instruction was organized around student learning rather than material coverage. Many of the instructional aspects were similar to her previous courses, but their implementation was different. Students were active participants throughout the lesson, providing the teacher with ongoing opportunities to monitor understanding and address misconceptions as they emerged. Notably, research supports the importance of active participation in learning from both neuroscientific (Goldberg, 2022) and mathematics education (Boaler, 2016) perspectives.

This responsiveness was evident from the beginning of each lesson. Warm-ups were implemented at the beginning of class to activate prior knowledge, address active misconceptions, and prepare students for the day's lesson. Rather than serving as a routine classroom activity, the warm-up became an instructional tool that allowed the teacher to adapt teaching to students' learning needs. Activating prior knowledge has been shown to support the development and retention of new understanding (Tomlinson & Sousa, 2020).

During direct instruction on notes, the teacher continually engaged students through questioning rather than relying solely on the delivery of information. These instructional decisions created a supportive environment in which students were positioned to succeed because instruction remained responsive to their developing understanding. Such responsiveness reflects the principles of the zone of proximal development, in which appropriate teacher support enables students to make continued academic progress (Baars & Wijnia, 2018; Bozkurt, 2017;

Goldberg, 2022). Rather than viewing misunderstanding as evidence of failure, the teacher used it to guide subsequent instruction and provide targeted support. In doing so, confusion became a productive source of information about students' thinking rather than something to be minimized or avoided. This classroom culture aligns with Boaler and Dieckmann's (2026) argument that embracing confusion is fundamental to developing mathematical mindsets because it encourages students to view struggle as a natural part of learning.

Consistent and reliable access to teacher support contributed to student learning. There exist positive emotional, neurological, and educational benefits of a supportive classroom environment as discussed in prior literature (Davidson & McEwen, 2012; Goldberg, 2022; Tomlinson & Sousa, 2020). The teacher expected confusion and verbalized the typicality of confusion, thereby lessening the embarrassment associated with it. The existence and anticipation of confusion within a classroom is supported by Ojose's (2008) belief that students within a single classroom will be at varying stages of understanding. A positive view on confusion and its ability to spur learning is supported by Dweck & Yeager's (2019) growth mindset and Boaler's (2016) mathematical mindset. When confusion was not cloaked in embarrassment, it provided direction for effective instructional support.

Maggie's narrative suggests that effective mathematics instruction is defined not by the amount of content covered but by the extent to which teaching responds to students' developing understanding. Her experiences demonstrate that a commitment to student learning requires teachers to continually monitor, interpret, and respond to students' thinking rather than simply deliver the prescribed curriculum. In this sense, teaching students is fundamentally different from teaching content.

Discussion of Cross-Narrative Ideas

Two cross-narrative themes that emerged from the data—engagement and perception—are now discussed. It is notable that these themes were common to multiple participants although embodied in different manifestations. Despite the presence of these themes throughout multiple narratives, there is not a desire to generalize these specific experiences to all students. Instead, the discussion on these cross-narrative themes may serve as an invitation to the reader to reflect on how their own students may uniquely experience and be affected by these themes.

The Power of Engagement

Looking across the six narratives, engagement emerged not simply as a classroom behavior but as the mechanism through which learning became possible. Although each participant encountered different barriers to engagement, meaningful learning consistently depended on students' ability to actively engage with mathematical ideas, teachers, and peers. The narratives suggest that engagement is not solely an individual choice but is shaped by social relationships, instructional practices, classroom culture, and students' beliefs about themselves.

Barriers to engagement for the participants emerged from multiple sources rather than a single cause. Consistent with Tong and An's (2024) assertion that educational outcomes are shaped by more than curriculum and ability, students' willingness and ability to engage were influenced by psychological, social, and instructional factors. Similarly, Bronfenbrenner's (1994) ecological perspective suggests that students' experiences are shaped through interactions among multiple influences rather than isolated characteristics.

Although each participant encountered a different barrier to engagement, the barriers clustered into three broad categories: internal, social, and instructional. Tanya's engagement was constrained by an internal belief that she was inherently incapable of learning algebra, making

engagement seem futile. Samantha and Paul experienced social barriers to engagement, although in different ways. Samantha's fear of peer judgment led her to avoid engagement, whereas Paul's engagement was shaped by the norms of his friendship group, in which engagement in learning was not socially valued. Melissa, Andy, and Maggie experienced barriers created through instructional contexts. Melissa withdrew after interpreting her teacher as unsupportive, Andy disengaged because his teacher accepted his lack of participation, and Maggie's opportunities to engage were limited by instruction that prioritized curriculum pacing over student understanding.

Although the sources of these barriers differed, they produced a common outcome. Each reduced students' opportunities to ask questions, contribute ideas, test their thinking, and receive feedback, all experiences that support mathematical learning. Looking across the narratives, engagement emerged not simply as a student behavior but as a condition shaped by students' beliefs, peer relationships, teacher interactions, and instructional practices. When access to engagement was diminished, students also lost access to many of the learning opportunities available within the classroom.

Looking across the narratives, access to engagement was restored through different, but related, conditions. For some students, engagement became possible when the social environment changed. Samantha experienced greater engagement after entering a classroom in which she felt socially safe and viewed her peers as fellow learners rather than sources of judgment. Similarly, Paul engaged more fully when the norms of his peer group supported engagement in learning. These experiences reinforce research demonstrating the importance of psychologically safe classroom environments for learning (Goldberg, 2022; Kolb & Gibb, 2011; Petrosini et al., 2009).

For other students, engagement was enabled through teachers' instructional and relational practices. Melissa became more engaged when she experienced a supportive relationship with her teacher, while Andy's engagement increased when high expectations were paired with consistent support. Maggie accessed engagement when instruction was responsive to her level of understanding, thus allowing her to focus on learning rather than merely keeping pace with the lesson. Together, these narratives suggest that teacher support extends beyond encouragement alone; it also includes creating instructional conditions that make engagement both attainable and meaningful. These findings align with research emphasizing the importance of supportive teacher relationships, appropriate challenge, and responsive instruction (Boaler, 2016; Boaler & Dieckmann, 2026; Bozkurt, 2017; Goldberg, 2022; Tomlinson & Sousa, 2020).

Although the pathways differed across participants, the outcome was remarkably consistent. Students engaged more fully when they perceived the classroom as socially, relationally, and instructionally supportive. Engagement therefore emerged not as a fixed characteristic of students but as a condition fostered through classroom relationships, peer interactions, teacher expectations, and responsive instructional practices. Across the narratives, meaningful engagement was created rather than assumed.

Throughout each core narrative the thread of accessing engagement was present and meaningful. The ability to engage fully in class cannot be simplified to a single cause and effect factor, but can be expressed in a multitude of different ways in students. Active engagement supports student learning and does not occur by accident, but the creation of access to engagement for students should be a motivating and necessary goal for teachers.

The Power of Perception

A second cross-narrative theme that emerged across the narratives was the power of perception. Participants responded not simply to classroom events themselves, but to the meanings they constructed from those events. Their perceptions shaped how they interpreted relationships, understood their own mathematical abilities, and ultimately engaged in learning. Presenting the findings through first-person narratives intentionally foregrounded each student's perspective. The reader is granted access into the students' thoughts and feelings. These thoughts and feelings are influential in the learning process and provide a rich understanding of the student perspective and experience (Desautels, 2016; Goldberg, 2022; Kolb & Gibb, 2011; Petrosini et al., 2009; Tomlinson & Sousa, 2020; Villavicencio & Bernardo, 2016). Students construct meaning from classroom experiences through their own perceptions, and those perceptions shape how they interpret relationships, instructional interactions, and their own mathematical abilities. Across the narratives, students sometimes described situations that readers may interpret differently. For example, Samantha perceived her classmates as continually laughing at her, Andy interpreted his teacher's actions as evidence that learning was unimportant, and Melissa became convinced that her teacher disliked her. Whether these perceptions reflected the objective reality of the situation is not the central concern of this study. Rather, the significance lies in the fact that students acted upon the realities they perceived. Their interpretations influenced their emotions, engagement, and meaning-making regardless of whether an outside observer would have reached the same conclusions. Thus, students' perceptions rather than the objective accuracy of those perceptions became the basis for their educational experiences.

Tanya's narrative provides the clearest illustration of the influence of perception because she later reflected on the inaccuracy of her earlier understanding of her classroom experiences. During Algebra 1, she believed she was significantly less successful than her classmates and constructed a mathematical identity around the belief that she was inherently incapable of learning algebra. Years later, she learned that many of her classmates had experienced similar struggles and that she had not been uniquely unsuccessful. Although her later understanding differed from her earlier perception, the consequences of that perception had already shaped her mathematical identity, confidence, and engagement. Tanya interpreted and responded to her classroom experiences based on what she believed to be true at the time. Thus, it was her perception of reality, not the objective reality itself, that guided her meaning-making and influenced her educational experience.

Students construct meaning from classroom experiences through their perceptions, and those perceptions shape how they think, feel, and act within mathematics classrooms. This finding is consistent with Bronfenbrenner (1977) and Thomas and Thomas's (1928) assertions that individuals respond to situations as they perceive them and that those perceptions have real consequences. Therefore, understanding students' perceptions is essential for understanding how they experience, interpret, and engage in mathematics learning.

Research Question

The major research question for this study asked *How do students who fail Algebra 1 describe their experience in Algebra 1 and their experiences in the subsequent years of high school mathematics coursework?* Findings suggest that participants understood and described these experiences through two primary lenses. First, they interpreted later mathematics experiences in relation to an initial negative Algebra 1 experience. Second, they described their

mathematics experiences in terms of the emotions those experiences evoked. Together, these findings suggest that students' experiences were shaped not only by classroom events but also by the meaning and emotional significance they assigned to those events.

First, a common way that participants described their experiences was with a focus on a specific struggle that emerged in their initial Algebra 1 enrollment. The impact of a singular initial negative experience was profound for students because its effects echoed throughout the student's subsequent mathematics experiences. The importance of interactions and events within an environment and their impact on development are emphasized in prior literature (El Zaatari & Maalouf, 2022; Tong & An, 2024). This is not to assert that a singular aspect was the determinant of struggle. Many factors contributed to both the participants' struggles and successes throughout their time in high school mathematics, which is consistent with Heyd-Metzuyanim's (2015) and Bronfenbrenner's (1977) assertions that experiences are impacted by many factors.

Melissa's experience illustrates this pattern. She described her initial Algebra 1 teacher as demonstrating little commitment to either her learning or her potential by citing the teacher's encouragement to copy classmates' work rather than receive instructional support. This experience became a recurring point of comparison throughout her interviews. As Melissa reflected on subsequent mathematics courses, she repeatedly evaluated teachers according to the degree to which they demonstrated commitment to helping her learn.

Andy's experience also illustrates this pattern. He described his initial Algebra 1 teacher as lacking instructional prowess, expressing a belief that his teacher did not possess the instructional skills needed to support student learning. As Andy reflected on subsequent mathematics courses, he repeatedly evaluated teachers according to their ability to effectively

explain content and support student learning. Thus, a participant's impactful negative experience at the beginning of their high school mathematics coursework resulted in their evaluation of subsequent courses in reference to the initial negative experience. The persistence or resolution of their initial negative experience became an evaluation tool for their following courses.

Second, participants described their experiences through the emotions they evoked. Although participants described specific classroom events and instructional practices, these descriptions were consistently intertwined with the emotions those experiences evoked. Participants did not simply describe what happened; they described what those experiences meant emotionally. This finding aligns with Tomlinson and Sousa's (2020) assertion that emotions are "a gateway to cognition and learning" (p. 18) and with Heyd-Metzuyanim's (2015) argument that emotions are among the critical factors shaping students' mathematical experiences. Further, emotions cannot be disregarded because they affect learning neurologically and socially through neuroplasticity, motivation, memory, and overall learning outcomes (Desautels, 2016; Goldberg, 2022; Kolb & Gibb, 2011; Petrosini et al., 2009; Tomlinson & Sousa, 2020; Villavicencio & Bernardo, 2016).

Samantha's experience illustrates how an instructional strategy intended to promote engagement instead became associated with anxiety and embarrassment, emotions the literature has linked to less productive learning experiences. Her teacher implemented an instructional strategy that is commonly considered good practice: turn and talk. Samantha's reaction to the use of turn and talk was described as anxiety-inducing and embarrassing. These negative emotions may have resulted in negatively affected learning outcomes, which is in line with the body of literature asserting negative emotions negatively affects learning (Boaler & Dieckmann, 2026; Chen et al., 2018; Desautels, 2016; Tomlinson & Sousa, 2020).

In contrast, Maggie described beginning the course with a review of prerequisite concepts as a source of relief and optimism. Rather than immediately feeling overwhelmed, she perceived the review as an indication that her teacher recognized students' needs and intended to support their success. The benefits of Maggie's positive emotional reaction are supported by Villavicencio and Bernardo's (2016) study on the link between positive emotions and mathematical outcomes. The students' mathematical classroom experiences and emotions were intertwined.

Together, Samantha's and Maggie's accounts demonstrate that instructional practices were experienced not simply as pedagogical choices but as emotional experiences. Similar instructional decisions could foster confidence, relief, anxiety, or embarrassment, suggesting that students evaluated classroom experiences through both cognitive and emotional methods.

Subquestion 1

The first subquestion for this study asked *How do students describe positive experiences in high school mathematics courses?* Participants described positive experiences as those that supported their learning and increased their likelihood of success in mathematics. Although enjoyable classroom interactions were frequently identified as positive, participants also valued experiences that challenged them when those experiences helped them learn and make progress toward passing the course.

Many of the specific classroom characteristics and teacher instructional choices that participants evaluated as positive are included in the core narratives of this study. On a macro level, participants described positive experiences as events, structures, and interactions that brought them closer to achieving their goal of learning and, ultimately, successfully completing their mathematics class. Some positive experiences reflected classroom characteristics

commonly associated with effective instruction. The aspects of classroom relationships and instruction that were enjoyable were expectedly described as positive. These findings are consistent with Desautels (2016), Tomlinson and Sousa (2020), and Villavicencio and Bernardo (2016), who argued that positive emotional experiences can facilitate mathematical learning. Participants identified collaborative peer interactions, supportive teacher-student relationships, engaging instructional activities, and organized classroom structures as positive experiences. Paul emphasized collaborative problem-solving with classmates, Melissa valued teachers who intentionally built relationships with students, and Maggie highlighted structured notes, instructional games, and interactive learning activities.

While participants appreciated enjoyable classroom interactions and engaging instructional activities, these characteristics alone did not define a positive experience. More fundamentally, participants evaluated classroom experiences according to whether they fostered understanding, supported persistence, and increased their confidence in their ability to succeed in mathematics.

More revealing than the enjoyable classroom experiences were those experiences participants ultimately described as positive despite being initially uncomfortable or challenging. Two examples from the findings were *cold calling* and high expectations from teachers. First, Maggie described cold calling as a positive experience. This was a surprising value determination because cold calling is a controversial instructional strategy. It is common for students to associate cold calling with anxiety, an undesirable emotion linked to negative learning outcomes (Boaler & Dieckmann, 2026; Chen et al., 2018; Desautels, 2016; Tomlinson & Sousa, 2020). Initially, Maggie did not appreciate cold calling because it did cause her stress, but as it became more engrained within the learning culture of the class, her perspective

transformed. Maggie's perspective of cold calling shifted as she experienced positive educational outcomes. Knowing she could be called upon at any time increased Maggie's attentiveness, commitment to note-taking, and motivation to understand the lesson. What initially produced anxiety ultimately became a source of engagement because it encouraged active participation in learning. Importantly, Maggie did not attribute the value of cold calling to the instructional strategy alone. Rather, its effectiveness depended on the classroom environment in which it occurred. The classroom culture emphasized comfort in expressing confusion and support from peers without embarrassment. Maggie's experience aligns with Goldberg's (2022) discussion of social and cognitive safety nets and with Dweck and Yeager (2019) and Boaler and Dieckmann (2026), who argued that students are more willing to engage in challenging learning experiences when mistakes are normalized and supported. Cold calling is an instructional strategy that is commonly cited as a negative experience for students and discouraged for teacher use, but situated within the appropriate classroom culture, it was a positive experience for students.

Second, participants described teachers who maintained high expectations while providing meaningful instructional support as having a positive influence on their mathematics experiences. Several participants described periods of disengagement when they experienced confusion or frustration. Rather than allowing students to withdraw, teachers who actively pursued and re-engaged stalled students were viewed positively. Andy's account illustrates this finding. He described choosing not to engage with an assignment, but rather than accepting his disengagement, his teacher encouraged him to continue working while providing the instructional support necessary to make progress. This provision of appropriate support is consistent with the components of Vygotsky's zone of proximal development and its educational outcomes (Baars & Wijnia, 2018; Bozkurt, 2017; Goldberg, 2022; Tomlinson & Sousa, 2020).

The teacher expected students to work on assignments; if they were not working on assignments, it was specifically addressed. The tone of teacher correction was not accusatory but one of encouragement cloaked in support. This call to action embodies the teacher's belief in the student's ability to learn and grow, and the finding is consistent with growth mindset literature that suggests that communicating belief in students' capacity to improve can promote engagement (Dweck & Yeager, 2019; Xu & Dieckmann, 2025). Likewise, Boaler (2016) argued that active engagement is essential for successful mathematics learning, while Vygotsky's concept of the zone of proximal development suggests that students benefit when challenging expectations are paired with appropriate instructional support (Baars & Wijnia, 2018; Bozkurt, 2017; Goldberg, 2022; Tomlinson & Sousa, 2020).

Ultimately, participants described positive experiences in their high school mathematics courses as those experiences that supported learning. Positive experiences were not always synonymous with fun or comfort, but rather were ones that supported student development and goal attainment.

Subquestion 2

The second subquestion of this study asked *How do students describe negative experiences in high school mathematics courses?* Participants most commonly described negative mathematics experiences as situations in which responsibility for the experience resided outside of themselves. Rather than attributing unsuccessful experiences primarily to their own actions, participants frequently interpreted teacher actions, instructional practices, and classroom conditions as the primary contributors to those experiences.

Participants most frequently attributed responsibility for negative classroom experiences to the teacher and teaching approaches. The way in which participants specifically talked about

negative experiences surrounding classroom behaviors serves as a prime example of this. Maggie attributed her inability to learn to the distracting classroom environment, which she believed resulted from ineffective classroom management. The fault was assigned to the teacher for not controlling the students in the classroom. Even when the participant recognized their own part in the experience, it was connected back to the teacher's shortcomings in some form. Although Paul acknowledged that he and his classmates chose to become distracted, he ultimately interpreted the teacher's inability to redirect the class as the underlying cause of the problem. Melissa shared an additional example of identifying an external locus of control. Melissa explained her disengagement as a response to a teacher whom she perceived as lacking concern for her learning. Throughout the examples provided from the core narratives, the ultimate cause of negative experiences existed outside of the student and with the teacher.

These findings can be interpreted through Weiner's attribution theory (Basturk, 2016) and Bandura's concept of self-efficacy (Bandura, 1989). Participants frequently made external attributions for their negative mathematics experiences, locating responsibility in teachers or classroom conditions rather than in themselves. Bandura (1989) suggested that individuals with high self-efficacy perceive themselves as capable of influencing outcomes, whereas study participants often described classroom circumstances as beyond their control. Likewise, Weiner's attribution theory proposes that the causes individuals assign to success and failure influence future motivation and behavior (Basturk, 2016). From the participants' perspectives, these external attributions shaped how they understood their experiences and opportunities for success. This interpretation also aligns with Bronfenbrenner's (1977) emphasis on the importance of contextual influences and Thomas and Thomas's (1928) assertion that situations defined as real become real in their consequences. Whether or not these attributions objectively

reflected the classroom circumstances, they represented participants' reality and influenced how they interpreted subsequent mathematics experiences.

Implications and Recommendations

The purpose of this study was to investigate the lived experience of students failing Algebra 1 and their experiences in subsequent high school mathematics courses. Although there was no attempt to assert that all students who fail Algebra 1 share identical experiences, the common themes identified in this study have broad implications on school policy and classroom student support. The discussion of the implications and associated recommendations of the study themes are divided into two groups. The first group is associated with school response following a student's failure of Algebra 1. The second group is associated with teacher actions applicable to all mathematics classrooms. All implications and recommendations are focused on ways to improve student learning experiences and outcomes.

The first recommendation is that schools create a policy requiring that students must successfully complete appropriate prerequisites prior to enrollment in more advanced mathematics courses. This policy should explicitly address subsequent course enrollment following an initial failure of Algebra 1, specifically Algebra 1A. Schools should consider implementing structured responses when students fail Algebra 1A rather than a passive response that involves automatically enrolling students in subsequent mathematics courses and assuming the factors that led the students to failure will resolve on their own. Failure of an Algebra 1 course does not happen by chance; there are dynamic factors that contribute to student failure. The common practice at Pacific High School was to enroll students in Algebra 1B regardless of their failure in Algebra 1A. This commonly resulted in one of two outcomes; either the student passed Algebra 1B, now having earned half a mathematics credit but lacking the algebraic

foundations necessary for future mathematical success, or the student did not pass Algebra 1B, compounding their experience of failure and doubling the required mathematics credits to be reattempted. Both possible outcomes are not ideal for students. Findings from this study suggest that automatically enrolling students in subsequent mathematics courses without additional intervention may be an insufficient response to Algebra 1 failure. Action is required to support academic reroute following failure. Failing Algebra 1 is not a singular event whose causes remediate themselves in the subsequent courses. Intentional school policy on course enrollment after failing Algebra 1A intended to interrupt sustained mathematical failure and provide students with adequate support to achieve learning and success is recommended.

The second recommendation is that schools create a standard response protocol for students who initially fail Algebra 1 (and possibly other mathematics courses) that establishes a standard post-failure meeting between the student and their academic counselor. The purpose of this meeting is to gain insight into the student's perception of the causes of their prior failure. This study supports the critical impact students' perceptions and feelings have on their educational experiences and outcomes. Student perceptions and feelings impact essentially all factors of their education; therefore, students should not be treated as unfeeling learners. After a student experiences initial failure, perceptions and emotions have been solidified based on that experience. Because the causes and factors contributing to student failure are vast, the student's voice provides an essential source of genuine insight into the student's experiences. This standard response protocol to Algebra 1 failure will provide an opportunity for students to share their perspectives and feelings and may result in two outcomes. First, students may be encouraged as they see their school intentionally seeking out ways to hear and support struggling students. Second, mathematics teachers of subsequent courses can have insight into effective and

ineffective methods of instruction and support for specific students, thereby allowing instruction to be responsive to student needs.

The third study recommendation is that teachers intentionally focus on creating a positive and productive classroom culture. Findings suggest that positive mathematics experiences are consistently associated with classroom cultures characterized by social safety, psychological safety, and active engagement. Findings suggest that the effectiveness of curriculum and instruction may be diminished when classrooms lack these characteristics. The criticality of the developed classroom culture is evident because study results indicate culture impacts the student's ability to participate with and engage in learning experiences. In some cases, aspects of classroom culture were cited by students as the determinant factor in their success or failure.

Classroom culture consists of many factors, each contributing in an impactful way to the overall culture. Social safety, psychological safety, and active engagement are three overarching necessary characteristics of a positive classroom culture. Within a classroom, social safety has been achieved when students are unafraid of negative social interactions or the possibility of negative social interactions. Examples of how a teacher can facilitate social safety within the classroom include modeling positive interactions with students themselves, facilitating interpersonal connections between all students, and maintaining clear expectations of kind interactions in class. Psychological safety has been achieved when students are unafraid of negative repercussions of mistakes or confusion. Examples of how a teacher can facilitate psychological safety within a classroom include emphasizing the process instead of the final solution, celebrating mistakes as a route to learning, and providing appropriate scaffolding to support students through struggle.

Active engagement is unattainable without a solid foundation of social safety and psychological safety in a classroom. Active engagement has been achieved when all students are active participants in their own learning because they engage with learning experiences. Examples of how a teacher can facilitate active engagement include integrating student voice through all aspects of instruction, providing clear expectations of assignments and activities, celebrating student effort, and providing support to further student understanding.

There are more strategies to foster social safety, psychological safety, and active engagement than can be enumerated here. Social safety, psychological safety, and active engagement working synergistically within a classroom culture can have a transformative impact on student learning. This researcher recommends classroom cultures that are founded on social safety, psychological safety, and active engagement for fostering mathematical growth in students.

The fourth recommendation is that teachers intentionally focus on creating student-teacher relationships characterized by both positive social and academic interactions. Findings suggest that positive student-teacher relationships involve more than interpersonal rapport. Participants consistently valued teachers who combined positive social interactions with clear academic support, high expectations, encouragement, and a demonstrated belief in students' ability to succeed. The specifics of a positive student-teacher relationship should be explicitly defined because a positive social relationship is necessary but insufficient for fostering an environment that contributes to academic success. Positive student-teacher relationships do involve social aspects that are foundational, but if the relationship stops on the social connection level, academic benefits may not be fully realized. In conjunction with the social relationship, the student-teacher relationship must include a positive academic component. A positive academic

relationship between teacher and student is characterized by the teacher's belief in the student's ability to learn and grow and the teacher's establishment of high student expectations. It also includes the teacher's active encouragement for the student to strive for understanding and achievement, and the teacher's unwavering and enthusiastic mathematical support. For a student-teacher relationship to be a significantly positive force for student learning, it must extend past a social connection and be characterized by an academic connection.

Collectively, these recommendations emphasize that improving outcomes after Algebra 1 failure requires more than curricular adjustments. Participants' experiences suggest that schools and teachers should intentionally create conditions that support students academically, socially, and emotionally. These conditions begin with school policies that respond proactively to failure and extend into classrooms where students experience supportive relationships, psychological safety, and high expectations paired with meaningful instructional support.

Recommendations for Future Research

This study focused on the experiences of six individuals from a rural Pacific Northwest community who failed Algebra 1 during their freshmen year of high school. The findings of this study emphasized the importance of comparison, peer relationships, teacher relationships, and instructional capabilities to student perception of failing Algebra 1 and their participation in subsequent mathematics courses. However, there remains a vast possibility of inquiries on the topic of student experiences and failing Algebra 1. The scope of this study was limited in order to facilitate the collection of rich stories from participants. The following four suggestions for future research provide possible direction for further inquiry that could provide insight into unique learners by developing a fuller understanding of their experiences and the systems in place to support them.

First, replicate this study with different participants. Due to the individualistic nature of a narrative inquiry, the understanding of the topic could be further explored by conducting a similar study with different participants. Similar themes may emerge from the collected interview data as emerged in this study, but the specific experiences, perceptions, and expression of meanings will still be unique.

Second, replicate this study with participants who failed Algebra 1 and did not graduate from high school. This study can explore the experiences of students who did not find success. Those individuals' stories and perspectives may provide an impactful insight into education.

Third, conduct a similar study with an expanded pool of educational stakeholders, including students, teachers, and parents. By expanding participation beyond solely students, the study will benefit from differing perspectives and possibly render different insights.

Fourth, conduct a similar study integrating a rigorous application of Bronfenbrenner's bioecological theory model. The impact of interactions, environments, and context is vast in this study. The application of the bioecological theory model may provide deeper insight into interactional impacts on student development and learning.

A tangential recommendation for future research is also suggested. Conduct a study on the congruency of the instruction in high school integrated mathematics courses to the integrated mathematics curriculum. Such inquiry may provide insight into the possibility that integrated mathematics is being repurposed as a remedial mathematics course.

Conclusion

The purpose of this narrative inquiry was to explore the lived experience of students who failed Algebra 1 and how they described their subsequent experiences in high school mathematics courses. This study was driven by one major research question, *How do students*

who fail Algebra 1 describe their experience in Algebra 1 and their experiences in the subsequent years of high school mathematics coursework?, and two subquestions: (1) *How do students describe positive experiences in high school mathematics courses?* and (2) *How do students describe negative experiences in high school mathematics courses?* A series of three interviews were individually conducted with six participants, each of whom had failed Algebra 1 during their freshman year of high school. Themes were identified in the interview data using the analysis of narratives methodology. Core narratives were then developed from the analysis of narratives themes using the narrative analysis methodology.

Individual core narratives expressed a variety of common themes shared by participants. The six core narratives each shared a unique finding. Tanya's narrative suggests that the way one perceives themselves in comparison to their peers has implications on identity development. Samantha's narrative suggests that belongingness shapes mathematics learning not only through students' feelings of acceptance but also through the degree of academic risk they perceive they can safely take. Paul's narrative suggests that students' decisions to engage or disengage may reflect attempts to maintain group membership as much as they reflect motivation or mathematical ability. Melissa's narrative suggests that teacher relationships shape not only students' emotions but also how they interpret classroom experiences and their willingness to participate in them. Andy's narrative suggests that meaningful engagement emerges when relational support and academic commitment work together. Maggie's narrative suggests that a commitment to student learning requires teachers to continually monitor, interpret, and respond to students' thinking rather than simply deliver the prescribed curriculum.

Across the narratives, two overarching themes also emerged. The power of engagement and the power of perception. The power of engagement suggests that active student engagement

supports student learning and rarely occurs without intentional actions by the teacher. The power of perception suggests that understanding students' perceptions is essential for understanding how they experience, interpret, and engage in mathematics learning.

Discussion of the major research question suggests that (1) the persistence or resolution of the participants' initial negative Algebra 1 experience became an evaluation tool for their following courses, and (2) instructional practices were experienced not simply as pedagogical choices but as emotional experiences. Discussion of subquestion 1 suggests that positive experiences were characterized by supporting student development and goal attainment, and not simply characterized by fun or comfort. Discussion of subquestion 2 suggests that, regardless of the actual classroom situation, participants identified the ultimate cause of negative experiences outside of themselves and with the teacher. The external attribution of negative experiences represented participants' reality and influenced how they interpreted subsequent mathematics experiences.

Together, these findings have both policy and classroom implications. Policy recommendations include the creation of (1) a policy focused on interrupting sustained mathematical failure by requiring that students successfully pass appropriate prerequisites before enrollment in more advanced mathematics courses, and (2) a policy focused on better supporting the failing student by gaining a deeper understanding of their feelings and perspectives through the creation of a standard response protocol that establishes a standard post-failure meeting between the student and his academic counselor. The classroom recommendation is that teachers focus on creating (1) a positive and productive classroom culture characterized by social safety, psychological safety, and active engagement, and (2) student-teacher relationships characterized by both positive social and academic interactions.

As the purpose of this study was to explore the lived experience of students who failed Algebra 1 and how they described their subsequent experiences in high school mathematics courses, the findings, discussion, and implications echo the deeply personal aspects of those experiences. The individual and communal, emotional and relational perceptions of participants profoundly impacted their experiences. Academically supporting students who have failed Algebra 1 pivotally relies on the acknowledgment and consideration of their unique experiences and perceptions.

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Appendix A - Study Summary for District

Note: This appendix presents the original study proposal provided to the school district. The option for participants to fulfill their Senior Service Learning Project was not approved and therefore was not part of this study.

Purpose/Rationale

Success in Algebra 1 is commonly considered a primary indicator of the future success of students in high school mathematics (Stoelinga & Lynn, 2013). The experience of failing Algebra 1 is not uncommon, with one study showing a 44% course repeat rate. Failing Algebra 1 has been shown to create an insurmountable gap between students who initially fail and those who do not (Heppen et al., 2017; Rickles et al., 2018). The proposed study will employ a narrative inquiry approach to collect and analyze the lived experiences of students who failed Algebra 1 and their lived experiences in subsequent high school mathematics courses. This study will provide insight into the experience of students who have failed Algebra 1 and identify common themes between those experiences. This research will provide insights that will allow educators to support student learning more effectively and reduce the high school mathematics achievement gap between those who initially failed Algebra 1 and those who did not. Specifically, the research question states, *How do students who fail Algebra 1 describe their experience in Algebra 1 and their experiences in the subsequent years of high school mathematics coursework?*

Benefits

Students, teachers, and districts could benefit from this research as it will provide insights into, and a robust description of, the high school mathematics experience of students who have failed Algebra 1. A student narrative that is not frequently emphasized will be told. Increasing

awareness and understanding of this student experience will allow for the development of educational improvements that will benefit students. I will be happy to share the results of my study with the district and teachers.

Methodology

This study will be conducted by employing basic qualitative research, specifically through narrative inquiry. Student mathematical experiences prior to Algebra 1, experiences in Algebra 1, and experiences in subsequent mathematics coursework will be the focus of inquiry. Participants will be selected on a volunteer basis, and participation will fulfill the student participants' Senior Service-Learning Project requirement. Data will be collected through the application of two strategies.

- First, high school seniors who failed Algebra 1 will be interviewed. Interviews will be structured around participants' mathematical educational experience in three phases: experiences prior to Algebra 1, experiences in Algebra 1, and experiences following Algebra 1.
- Second, transcripts will be analyzed to contextualize interview findings.

The collected data will be analyzed through the identification of themes and the analysis of those themes (Daiute, 2014).

The Ask

I am requesting that the district support my collection of interview data and approve participation in this study as fulfillment of the required Senior Service-Learning Project credit. I am also requesting access to student transcripts for analysis.

Risks

It may be difficult to gain access to students who are willing to participate in this study. A requirement for participants is the failing of Algebra 1. Students may feel embarrassed or ashamed of failing, causing them to be unwilling to share their experiences. Structuring their participation as a service that will benefit others may alleviate some of these concerns. If needed, participants can be referred to the school counselor to support processing the emotions that may be brought up from the interviews.

Appendix B - School District Requests

Needs for Document Analysis

- Transcripts for all enrolled 2025 seniors—It would be beneficial if I could have access to the transcripts at the beginning of the school year (September). Receiving transcripts either through electronic means or through physical copies would be fine, at the district's preference. This would allow me to track the progress of students in their mathematics courses throughout the years.

Needs for interviews

- A series of 3–5 interview sessions with 10–15 seniors graduating during the 2024–2025 school year;
- Space to conduct interviews, such as a conference room or classroom; and
- Access to student participants for interviews during either lunch, study hall, or immediately after school.

The students selected for participation will have to meet three criteria: (1) have failed Algebra 1, (2) scheduled to graduate in the 2024–2025 school year, and (3) willingness to commit to participation in the series of interviews.

Each interview session will have a minimum of 1 week between interviews to allow time for both participant and researcher to reflect on data that may or may not affect subsequent interview questions. Ideally interviews would begin as early as September and conclude by winter break, at the latest. This timetable is tentative based on the number of participants for the study.

Students can volunteer to participate by responding to an advertisement or through the recruitment by a counselor. Participation can fulfill the requirements of their senior service

project if desired. Students can also initiate participation any time prior to the middle of November. All participants will receive a \$25 (changed to \$100 during participant recruitment) Dutch Bros. gift card at the completion of the interviews.

Any and all identifying characteristics of participants will be removed to ensure the anonymity of the student and district.

Appendix C - Initial Participant Interest Email

Greetings!

My name is Kat Haynes, and I am a math teacher at [the Fir Program]. I want to learn from your math class experiences to help improve high school math for future students. I was given your name as someone who might be interested in participating in a research study about students' experiences in math classes after not passing Algebra 1. Your participation is entirely voluntary and completely anonymous—your name and any identifying information will not be connected to your response.

Why participate?

- You'll receive a gift bag with treats, including a Dutch Bros. gift card.
- You'll gain personal empowerment by sharing your experiences.
- What we learn from you will inform improvements to the way we teach math and help future students.

What is required of you?

- Participation in three separate interviews (about 1 hour each). Interviews will happen at [Pacific High School] during the school day. I would be happy to provide food for you.
- A willingness to share your experiences and stories from your various math class enrollments.

What are the risks?

- While I am a friendly person and easy to talk to, interviews can be stressful for some people. You may feel stress from discussing prior negative math experiences.

I hope you will participate and share your valuable experiences with me. What you have to share is important! To express interest in participating, please respond to this email!

Kat Haynes