2018

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Assessing the Relationship of Grit and Student Achievement in Reading and Mathematics in Second Grade Students of the Sault Ste. Marie Public School District

by

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Dissertation

Submitted to the Department of Leadership and Counseling

Eastern Michigan University

In partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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October 29, 2018

Ypsilanti, Michigan

ACKNOWLEDGEMENT

I would like to thank my dissertation committee, Dr. David Anderson, Dr. Brigid Beaubian, Dr. James Berry (chair), and Dr. William Price, for the time and efforts they have devoted to me through my lengthy dissertation process. I have to extend additional accolades to my committee chair, Dr. James Berry, whose patience with me was nothing short of admirable. He was always willing to take the time for numerous phone conversations and emails over the years it took me to complete my dissertation. He never gave up on me, and always encouraged me to keep moving forward, even when I was ready to give up. I will be forever grateful for his guidance, support, continuous feedback, and seeing me through to the fruition of my dissertation.

I am thankful that I work in a school district that fully supports administrators to further their education. I could not have completed this journey without the support of my superintendent, Dr. Tim Hall. He was a constant source of encouragement and support, through my course work and my dissertation. He was there for me when I needed to talk through an idea, needed assistance, or just needed a pep talk.

A special note of appreciation has to be sent to Dr. Richard Conboy, who came to my rescue when the statistical portion of my dissertation was causing me great angst. I honestly don't know what I would have done without his hours and hours of guidance and assistance.

Finally yet important, my family deserves sincere acknowledgment and thanks for the continuous support and love they provided me through my graduate school journey. I could not have completed this journey without the endless support and love from my parents, Midge and Wayne Trepanier. As I worked to grow my professional career and continue my education they were always close at hand, willing to help with my children, household tasks, and just being there for anything I needed. A special thank you to my children, Jeffrey and Kevin, who were so

patient and understanding when my studies interfered with some of our plans and special events. Sincere appreciation goes to the man in my life, Dan Buhro, who endured many sacrifices while the completion of my graduate journey consumed me. Without complaint, he provided unceasing love and support for which I am eternally grateful.

Abstract

The single most common predictor of success may be how hard students work. Students who persevere when faced with challenges and adversity have grit. This quantitative study explored the relationship of grit and student achievement in students in early elementary school. The subjects of the study were second grade students enrolled in the Sault Ste. Marie Area Public School District. The cognitive measures for this study were the subjects' scores from the Northwest Evaluation Association's Measures of Academic Progress in the areas of mathematics and reading. The non-cognitive measure for this research was the Grit-S Scale, which provided a grit score for each of the subjects.

The results of the study established a highly significant moderate to strong relationship between grit and student achievement in both mathematics and reading as students exited second grade. A significant strong relationship was established between students' mathematics and reading scores at the end of second grade. The results also demonstrated a moderate to strong relationship between a student's grit and socioeconomic status and school attendance. The study's results have the potential to provide evidence as to the importance of non-cognitive skills in relation to academic success of students. The results lend knowledge to the field of education about the importance and value of explicitly teaching and supporting non-cognitive skills such as resilience, conscientiousness, optimism, self-control, goal commitment, perseverance, and grit within the classroom. The results of this study showed support for the link between grit and student achievement in students who are just embarking on their educational journey.

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CHAPTER 1: INTRODUCTION

Background

The interest for this study was conceived from being part of a district that administers multiple assessments to make educational decisions for learners of all ages. This has been a practice in the district for at least the last 20 years. Over the years, the instruments have changed, but the focus of determining academic achievement has not. What makes a student ready for learning or what makes him/her a good learner?

Educators posit that how hard students work may be the single most common predictor of success (Tomlinson, 2013). Students who persevere when faced with challenges and adversity, have grit (Duckworth, Peterson, Matthews, & Kelly, 2007). This study aimed to determine if grit is a missing social-emotional factor when determining or predicting student achievement. This study has a value decision for school districts as districts spend a great deal of money each year on assessment measures. Are districts using an effective tool to determine achievement? Can districts employ a teaching focus on non-cognitive skills that result in increasing student achievement? Student success has huge implications for funding for each school district. If there is a significant relationship between a student's grit score and academic achievement, districts can explore methods to develop a student's grit, which would increase the district's chance of academic success for all students, therefore maintaining or enhancing federal and/or state funding for the district.

Statement of the Problem

The problem is that the achievement assessments most often adopted by a school system only assess skills in the cognitive domain. Learning how to better prepare students for academic success is a top priority for educators because of high-stakes testing, which often affects revenue

for a district. This research was designed to explore academic success in young learners in elementary school by contributing to a deeper understanding of the relevance of non-cognitive skills, specifically grit, as a means to increase future positive academic outcomes.

A great deal of evidence has lead researchers to believe there is a relationship between how hard students work and their success in the academic arena and overall life satisfaction (Tomlinson, 2013). Students who persevere when faced with challenges and adversity have grit (Duckworth et al., 2007). Duckworth et al. (2007) resolve that grit is vital to superior achievement, and of more importance than intelligence and ability. Grit and other non-cognitive skills have the potential to be explicitly taught and fostered within learners of all ages, which in turn, enhances students' cognitive skills that leads to increased student achievement.

Each school year, millions of dollars are spent assessing students for various reasons. The bulk of the screeners and assessments utilized to determine academic achievement seek to measure only the cognitive skills associated with school performance. Current research supports the need to look beyond cognitive skills, as measures of academic performance and delve into non-cognitive skills such as resilience, conscientiousness, optimism, self-control, goal commitment, perseverance and grit, as measures of academic performance and possible predictors of future success (Tough, 2016; Pritchard & Wilson, 2003).

Studies of non-academic skills as measures of academic achievement are not new to the field of education. Psychologists have established these non-cognitive skills as reliable, valid, measurable, and highly predictive of future outcomes decades ago (Bandura, 1977). This belief has resurfaced when in December 2015 the Every Student Succeeds Act (ESSA) was signed into law. ESSA has sparked a newfound interest in utilizing non-cognitive skills as measures of student success. ESSA requires states to include at least one non-academic measure in their

accountability systems. ESSA also includes the provision of federal funding for the purpose of exploring, field-testing, and utilizing non-cognitive measures of student success or achievement.

With resurfacing interests in the importance of the relationship between non-cognitive skills and academic success, the problem arises that there are few studies that focus on the relationship between non-cognitive skills and the academic success of students in early elementary school. Students in Sault Ste. Marie Area Public Schools (SAPS) are administered the Northwest Evaluation Association's (NWEA) standardized Measures of Academic Progress (MAP) assessment at least three times per year, from kindergarten entry until Grade 10. The district uses the scores to drive instructional decisions; make classroom placement decisions; determine who receives intervention supports; and compare student achievement at the classroom, building, and district level. The students' MAP scores are also utilized as part of the SAPS teacher evaluation system to determine teacher effectiveness. Despite the research that shows the importance of non-cognitive skills in academic achievement, there is not an assessment used in SAPS that measures or addresses non-cognitive skills, nor is there a systematic focus or approach to incorporate the development of non-cognitive skills into instructional practices. To date, there has not been a systematic investigation to study the relationship of non-cognitive skills, specifically, grit and achievement growth in students as they progress from kindergarten through the completion of second grade.

Theoretical Framework

The theoretical framework for this study is grounded in Alfred Bandura's (1977) social cognitive theory. Bandura posits that learners are only able to learn if they are motivated to stay on task (self-regulation and self-efficacy) to gain an understanding of what is to be learned. Self-efficacy is an especially critical influence on motivation and affects learning choices, effort, and persistence, which all lead to achievement. Furthering the theoretical frame is Angela Duckworth's (2007) grit theory as related to academic success. Once a student is motivated to learn, Duckworth's concept of grit determines if learners are motivated to set a goal for their learning and persevere until the goal is attained. The final piece to this theoretical frame is the theory of mindset (TM; Dweck, 2006), the belief that in order for the most learning to occur, one must have a growth mindset, a belief that continual learning can take place over the span of life.

Applying this theoretical frame to the measurement of academic success urges one to explore the notion that academic success is measurable by more than cognitive skills. The importance of non-cognitive skills as measures of academic success is of equal importance. Combining the theories of Bandura, Duckworth, and Dweck, one can surmise that a student may demonstrate cognitive skills as they enter the world of academia, but if they do not believe they can learn and they do not have grit; thus, their academic success will be limited. Applying this theoretical frame, if a student starts school with limited cognitive skills but is motivated to learn, has grit, believes he/she can learn, and is provided appropriate instruction, the likeliness of academic growth and success is elevated.

Purpose of the Study

The purpose of this quantitative study was to test the hypothesis that students' academic growth on MAP assessments of early elementary students in the areas of mathematics and reading are correlated to the student's grit. The study took place in SAPS, a rural school district in the eastern upper peninsula of Michigan. The population chosen for this study were students continuously enrolled in SAPS since the 2015-2016 school year and in second grade during the 2017-2018 school year. Only second graders were chosen, as this population would have been administered the MAP assessment as they entered kindergarten and administered the MAP at least three times per year in each school year. This population of students included students who attended junior kindergarten or retained in kindergarten prior to entry into kindergarten for the 2015-2016 school year. Adding this element allowed the exploration of age as a factor, and effects of attending junior kindergarten or repeating kindergarten as factors when entering kindergarten.

1. Is there a significant positive correlation in the increase in reading achievement scores between kindergarten and second grade students who have higher levels of grit than those who have lower levels of grit?

2. Is there a significant positive correlation in the increase in mathematics achievement scores between kindergarten and second grade students who have higher levels of grit than those who have lower levels of grit?

3. How do grit and kindergarten MAP entrance scores compare as performance predictors for second grade students' mathematics and reading scores?

4. Does gender, age at kindergarten entry, and socioeconomic status correlate with students' grit scores?

Glossary of Terms

Cognitive skills are skills related to academic performance in the traditional curricular core content areas such as reading, writing, mathematics, science, and social studies. These skills are often described as thinking, learning, reasoning, understanding, comprehending, and synthesizing information (Arguedas, Daradoumis, & Xhafa, 2016).

Fixed mindset is a belief system that suggests a person has a predetermined amount of intelligence, skills, or talents (Ricci, 2013).

Grit is a person's ability to set a goal and persevere over time until the goal has been met (Duckworth, 2007; Hanford, 2013). Using a five-point scale, a grit score for each subject will be determined upon completion of the Grit-S survey.

Growth mindset is a belief system that posits that learning continuous throughout one's lifetime. This belief relates to being able to develop both cognitive and non-cognitive traits over the span of one's life (Ricci, 2013).

Non-cognitive skills are skills based on character traits and are not related to performance in the traditional curricular core content areas such as reading, writing, mathematics, science, and social studies (Steiner-Adair, 2014). Non-cognitive skills can be described as character traits such as conscientiousness, courage, grit, optimism, perseverance, resilience, and self-control (Tough, 2016).

Zone of Proximal Development is a concept developed by Lev Vygotsky, which equates to a learner's instructional level. It is described as the distance between the actual development levels of a student and the potential development level of the student (Gillani, 2003). When provided with appropriate learning tools and opportunities the student moves up a level of development or achievement to another in a cyclical fashion as more learning occurs.

Limitations and Delimitations

The teacher rating of the students' grit score limits this study. Although the Grit-S has been determined to be valid when using an informant (Duckworth & Quinn 2008), personal bias should be considered when interpreting results. A further limiting factor is the students' MAP score as the measurement of academic achievement in reading and mathematics as each of the students took the test with their classmates at an individual computer station in the school's computer lab with the classroom teacher as the proctor. It is an assumption that each student completed the assessment with fidelity.

The study is delimited to second grade students in a rural school district in the northern Michigan whose permission to participate was provided by each student's parent. Another delimiting factor is the use of existing quantitative data such as the past and present student achievement scores reported and demographic information within the district's student information system.

Significance of the Study

Millions of dollars are spent each year assessing students from the time they enter kindergarten until they graduate from high school. The bulk of the assessments utilized to determine academic achievement seeks to measure and cultivate only the cognitive skills associated with school performance. Current research supports the need to look beyond cognitive skills as measures of academic success and delve into the role of non-cognitive skills such as resilience, conscientiousness, optimism, self-control, goal commitment, perseverance, and grit as measures of achievement and possible predictors of future success (Tough, 2016; Pritchard & Wilson, 2003).

Currently SAPS spends a great deal of time assessing mathematics and reading abilities of students across the district. The scores collected make placement and instructional decisions for the students. This study demonstrates the assessments currently utilized to determine achievement may only be a small part of the measurement of student success.

Grit may be a better predictor of future academic success. Applying the theoretical frame to student achievement, it behooves a district to move away from the assessment of mathematics and reading scores and move towards the assessment or measurement of non-cognitive skills, specifically grit. The advantages of knowing a student's grit score will provide the teacher insight into the student's motivation to learn. The powerful piece of this knowledge is grit can be developed and learned. Grit has demonstrated to be a good determinant of success in adults. Providing this study demonstrates grit is measurable in young students, this will unlock teachers' ability to grow a learner rather than just be a giver of knowledge. Summarizing the beliefs of Vygotsky (1998), traditional approaches of assessment offer information about "yesterday's functioning" and provide limited information that is useful for planning for the future.

CHAPTER II: REVIEW OF THE LITERATURE

Introduction

This section provides a review of the literature and research related to the relationship between student achievement, grit, and the role of non-cognitive skills in academic success. The literature is organized into seven components. The first component reviews non-cognitive factors in the pursuit of determining student achievement. The second component explores theories of motivation as related to grit and student achievement. The third component pertains to grit theory and how this may be the key to predicting and building academic success for students. The fourth component delves into mindsets and the relationship to motivation, grit, and student achievement. The fifth component is a closer look at the zone of proximal development as related to motivation and student learning. The sixth component provides a snapshot of the use of zone of proximal development in the development and acquisition of the Measurement of Academic Progress. The seventh and final component of this chapter hones in on self-efficacy and the role it plays in student motivation, learning, and achievement.

Looking Beyond Measuring Cognitive Skills

The study of learning takes on many forms in terms of a child's acquisition of skills. There is merit to each theorist, both past and present, who proposed ideas for understanding the acquisition of academic skills. Not all learners are created equal, and there is not a-one-size-fits-all theory. Each educator needs an arsenal of theories, beliefs, and practices to effectively meet the needs of all students. Combining the beliefs of theorists, one can conclude student-learning needs to include all of the following components: motivation, physical development, intellectual ability, emotional maturity, and health. The National Education Goals Panel (2012) encompassed similar development components, referred to as the dimensions of school readiness: physical

well-being and motor development, social and emotional development, approaches to learning, language development, and cognition and general knowledge. A student may not be "ready to learn" until each of the components are addressed. Learning is often episodic at an individual pace. In most cases, children all meet the established developmental milestones. The rate and sequence, however, are different for each child. There is a need to educate the whole child at their current individualized point of development rather than trying to assimilate the child to the current program. This means having a clear picture of not only the cognitive skills of a student, but also the non-cognitive skills the student possesses.

Non-cognitive skills as measures of achievement are not new to the field of education. Historically, researchers in the field of education have supported the belief that student success can be measured in the form of non-academic skills (Bandura & Schunk, 1981; Ames & Archer, 1988; Zimmerman, 1990; Farington, et al., 2012). Psychologists have established these non-cognitive skills as stable, measurable, and strongly predictive of future outcomes for decades (Bandura, 1977). This belief has resurfaced with the December 2015 Every Student Succeeds Act (ESSA). ESSA has sparked a newfound interest utilizing non-cognitive skills as measures of student success because students are required to include at least one non-academic measure in their accountability systems. ESSA also includes the provision of federal funding for the purpose of exploring, field-testing, and utilizing non-cognitive measures of student success or achievement.

Non-cognitive skills are the skills founded in character traits as opposed to skills founded in the basic core subjects: reading, writing, mathematics, science and social studies (Steiner-Adair, 2014). Non-cognitive skills include, but are not limited to, resilience, conscientiousness, optimism, self-control, goal commitment, perseverance, and grit (Tough, 2016; Pritchard &

Wilson, 2003). Non-cognitive skills in the education arena that are linked to student

achievement are behaviors (e.g., being a regular active participant in class), perseverance (e.g.

grit and hard work), mindsets (e.g. feeling sense of belonging and believing in self), and social

skills (e.g., getting along with others; Farington et al., 2012). Educators posit that how hard

students work may be the single most common predictor of success (Tomlinson, 2013). Students

who persevere when faced with challenges and adversity have grit (Duckworth et al., 2007).

Social-emotional development encompasses the relationship a person has with others, the

level of self-control, and the motivation and perseverance a person has during an assigned task.

Social-emotional development is typically divided into three main categories: attachment,

initiative and self-regulation (self-control; Thompson, 2002). Research conducted in the last 20

years highlights that deficits in any of these areas impact a student's academic performance, yet

these characteristics of learning are often overlooked when determining academic achievement

(Child Trends, 2002; LaParo & Pianata, 2000). The emphasis on determining academic

achievement still relies on academic skills, which continues to overshadow the role social-

emotional development plays in the rigor of the achievement expectations in today's schools

(Raver & Zigler, 1997). The importance of motivation in older students has been clearly

established in past research (Nicholls, 1979). Research that is more recent found these same

motivation constructs manifest in children as young as four or five years old (Smiley & Dweck,

1994). The notion of social-emotional skills being linked to early academic success is getting

recent attention (Wenzel & Asher, 1995). Research further supports a firm foundation of

students' social emotional skills leads to academic achievement in their first few years of school

(Ladd, Kochenderfer, & Coleman, 1997; O'Neil et al., 1997). A study conducted by Shala (2013)

not only confirmed the association between social-emotional development and academic

achievement in elementary school, but the study determined that social emotional development could predict later academic success. These findings supported previous research which concluded that students need a combination of intellectual skills (cognitive), motivational qualities (non-cognitive), and social-emotional skills (non-cognitive) for academic success (Thompson, 2002).

Motivation Theories

Motivation and grit encompass components of social-emotional development that are interrelated, which forms a solid foundation for student success. In order to connect the concept of social-emotional development and student achievement as it relates to grit, a deeper understanding of motivation is warranted.

The socio-emotional factor called motivation demonstrates as a predictor for school success (Elliot & Dweck, 1988). Many theories across developmental periods posit that emotion, interest, and task engagement are key components of the non-cognitive skills of motivation and self-regulation for children and adults (Bandura, 1997; Connell & Wellborn, 1991; Smiley & Dweck, 1994, Sansone & Thoman, 2005; Silvia, 2008).

At the turn of twentieth century, John Dewey explained that only a student's own internal motivation could provide the initiative for long-term successful learning (Gruender, 1996). Internal motivation is also known as intrinsic motivation. Students who are intrinsically motivated will choose a task or set a task-oriented goal just for the enjoyment of the task itself. Students with intrinsic motivation will choose challenging tasks even if the completion may not be successful. Intrinsically motived students are more likely to rely on their own abilities to problem solve through the completion of a task. Conversely, students with external motivation need to know there is a tangible reward when a task is completed. Externally motivated students

will be reluctant to begin a task if success is not certain (Smiley & Dweck, 1994). Externally

motived students will look for assistance when given a problem to solve prior to expending much

effort (Dweck, 1986).

Bandura (1977) posits the key to motivation is held in the process of goal setting, social

comparisons, evaluation of goals, and outcome expectations. Through their goal-setting theory,

Locke and Latham (2002) posit there is a significant relationship between established goals and

student performance. Goal setting generates motivation in students, and goals lead students to

invest in their learning and take ownership of their learning outcomes (Locke & Latham, 1990).

Learning how to establish goals and reflecting on those goals has proven to positively affect

motivation in students (Koh, 2010). Goals are used to establish learning targets and as a

continued source of motivation. Motivation is sustained through progress towards predetermined

goals and self-efficacy while using social comparisons to provide feedback on goal progress and

goal attainment. Seeing the progress toward the goal becomes the motivation to continue to the

fruition of the goal.

In goal-setting theory, the complexity of the task is relational to the effort the student will

expend for goal attainment. Locke and Latham (2002) have found that a goal that is moderately

difficult to achieve promotes the most effort on the part of the student. This directly relates to the

importance of Vygotsky's Zone of Proximal Development (1978).

According to Ford (1992), motivation is a triad of goals, emotions, and personal agency

beliefs. The triad that depicts the research of Carol Dweck and Angela Duckworth is grit, self-

efficacy, and theory of mind. Recent research has linked this triad to successful adults, high

school students, and middle school students. The concepts of grit, self-efficacy, and theory of

mind, have begun to show promise as predictors of success in later elementary school studies and is emerging into studies in elementary school.

In order to have belief in one's ability to start a goal, one must have self-efficacy, and belief in self; and lastly, one must believe growth is continuous and not fixed. In the classroom, teachers accept the importance of motivation for academic success of their students. Yet, little importance has been placed on explicitly teaching motivation or other non-cognitive skills in the classroom. Students, at a very young age, can be taught strategies to reflect on their own learning. Actively teaching goal setting, organizational skills, and persistence to students fosters the development of motivation, attention to detail and intrinsic motivation (Locke & Latham, 2002).

Grit Theory

Grit is a person's ability to establish and stick with a goal until the goal is achieved (Duckworth, 2016). Duckworth (2009) defined the term grit as perseverance and passion for long-term goals. A person with grit is driven toward goal attainment, much as a runner embarking on a marathon (Duckworth et al., 2007; Duckworth, Quinn, & Tsukayama, 2012). In the educational arena, a student with grit would be described as engaged, focused, and driven to achieve academic goals even if obstacles or distractions get in the way (Farington et. al, 2012). Grit emphasizes determination, endurance, tenacity, and conscientiousness and does not allow failure, lack of progress, or laboriousness to deter goal attainment.

Duckworth (2009, 2016) and Dweck (2008) are the leading researchers in the non-cognitive construct of grit, which affects performance and the attainment of long-term goals. Both researchers have conducted experiments to determine if grit or other non-cognitive skills are predictors of long-term success. (Duckworth et.al., 2007; Duckworth et al., 2012).

Grit studies include diverse populations under various conditions in various professional arenas. The professional arenas in which grit has been examined are competitive settings including the military (West Point cadets), spelling bee competitions, and universities in the Ivy League (Duckworth et al., 2007; Duckworth et al., 2009; Maddi et al., 2013; Maddi et al., 2012). Eskreis-Winkler et al. (2014) published a paper about the influence of grit on retention in four different sample populations: high school juniors, sales representatives, soldiers, and married adults. Grit was found to have a positive correlation with success in each of the four populations studied. High school juniors with high grit scores were likely to graduate from high school. After three months, the sales representatives with high grit scores were more likely to retain employment. Soldiers with high grit scores were more likely to complete their military program. In the study of married men, those with high grit scores were found to stay married as compared to those with lower grit scores.

An early study on grit examined why some people with a high IQ are not the best in their field and why some people exert more effort in their work environment (Duckworth, et. al., 2007). In a related study, the behaviors and attitudes of high-achieving professionals (e.g., dentists, lawyers, doctors, and others) were measured. The research determined that higher educated subjects had more grit than same age subjects did with less education. Another significant finding of this study was that those who had more persistence or drive for reaching their goal were more successful in higher education (Duckworth, 2016).

Further studies were done involving populations working in extreme stressful working environments such as novice teachers (Duckworth et al., 2009), physicians (Reed, Schmitz, Baker, Nukui, & Epperly, (2012)), medical residents (Salles, Cohen, & Mueller, 2014), and minority college students at predominantly white institutions (Strayhorn, 2013). Those with more

grit were more successful in their chosen careers, had a higher rate of collegiate completion, and reported overall life satisfaction (Duckworth et al., 2009; A. J. Reed et al., 2012; Salles et al., 2014; Strayhorn, 2013).

Grit has been found to be predictive of positive life outcomes in at least three studies. A.J. Reed et al. (2012) concluded a positive correlation between grit and overall life satisfaction. Salles et al. (2014) further refined over all life satisfaction by looking at well-being, and grit. Von Culin, Tsukayama, & Duckworth, (2014) investigated happiness as correlated to grit. The studies named above concluded the grittier person experienced greater life satisfaction, well-being and happiness
(A.J. Reed et al., 2012; Salles et al., 2014; Von Culin et al., 2014).

Duckworth's many studies on grit suggest grit can predict retention and success in multiple arenas: vocational, military, and academic (Duckworth, 2016; Duckworth et. al., 2007). The grit theory brings together multiple theories of goal attainment, perseverance, motivation, and self-efficacy. The grit theory helps explain and understand goal attainment for both short term and long-term goals. A person with grit embraces goals and lets nothing stand in the way of achieving the goal.

Of the numerous studies conducted by Duckworth between 2007 and 2016, a consistent finding was grit predicts success better than IQ. Studies conducted in 2007 and 2016 both came to the same conclusion that grit may be a better indicator of success than IQ.
If grit is proving to be an indicator of success in teen-age students and adults, exploring grit as a possible indicator of kindergarten readiness and early learning has promise.

Carol Dweck's Fixed and Growth Mindset

Students who value effort are said to have a growth mindset and with that belief comes the belief that ability and skill are both malleable across a lifetime. On the other end of the spectrum is the fixed mindset. Students with a fixed mindset think intelligence is fixed or stagnant; therefore, the belief is more effort will not make a difference in the outcome.

Carol Dweck's (2008) theory of mindset (TM) explains the characteristics, roles, and applications of a fixed and growth mindset. According to Dweck (1999, 2007, 2010) and Duckworth, et. al., (2007), grit is the notion behind TM. Research demonstrates that our accomplishments and things we value are affected by the beliefs we have of ourselves (Dweck, 2010a). Connecting TM and grit will give more power to understand the relationship between grit and student achievement.

The book authored by Dweck (2008), *Mindsets: The New Psychology of Success,* provides an in-depth look at growth and fixed mindsets. Dweck (2008) describes mindsets as "powerful beliefs…but they are just something in your mind, and you can change your mindset through experiences, training, and personal effort."(p. 6). TM has the conviction that everyone is born with the sense to learn, infants and young children move through their developmental milestones with this sense to learn, and children begin school believing they can learn.

Students with a growth mindset believe that they can learn anything and that intelligences are developed (Dweck, 2010b). Students with a fixed mindset posit everyone is born with a finite amount of intelligence and more cannot be learned (Dweck & Mueller, 1998). When students start school, they begin to gage themselves within the educational setting and compare to their classmates. A fixed or growth mindset emerges through these comparative experiences (Dweck, 2008b).

There are recent studies that demonstrate TM in a classroom. The first was a study organized in a preschool classroom by Dweck (2008b) using jigsaw puzzles. Once the puzzles were completed, one group of students was told how smart they were and the other group of students was told they had put a lot of effort into the puzzle completion. The students who were told they were smart chose easier puzzles when given a choice. The students who were told they put a lot of effort into their puzzles chose the more difficult puzzle. The fear of failing drove the students who had been told they were smart to choose the easier puzzles. The students complimented on their efforts chose the harder puzzles because they believed their efforts made a difference. Dweck (2008) concluded the group choosing the easier puzzles had a fixed mindset and those who chose the harder ones had a growth mindset.

A TM longitudinal study that began in a kindergarten classroom explored students' beliefs about intelligence. One classroom made up of high-poverty students and the other classroom was primarily middle-class students. During their kindergarten year, all students showed a growth mindset (Ricci, 2013). The study followed this same group of students through third grade. As the students increased in grade level, there was a decrease in growth mindset. The conclusion of the study found there was a correlation between growth and fixed mindset and students' progression through school (Ricci, 2013).

In Ricci's (2013) book, *Mindsets in the Classroom: Building a Culture of Success and Student Achievement in the Schools,* an eight-year-old student was used to described the beliefs of a student with a fixed mind set. This student believed that another student in the classroom was smarter and, no matter the effort put forth, the other student was permanently smarter than he was. Believing abilities are preset characterizes a fixed mindset. A person with a fixed mindset will believe others also have a fixed mindset.

Carol Dweck (2008) posits, "Mindsets are an important part of your personality, but you can change them just by knowing about the two types of mindsets and how to think and react" (p. 46). In order to help students believe they can, teachers need to believe in a growth mindset. A growth mindset goes hand in hand with the Measurement of Academic Progress (MAP) assessments used in Sault Area Public Schools. One feature of the MAP reports is the goal-setting worksheets generated for each student based on their achievement score in each content area. More detail about MAP is in a later section of this dissertation.

Lev Vygotsky's Zone of Proximal Development (ZPD)

One of the most popular notions of the Russian theorist, Lev Vygotsky is ZPD. ZPD is defined as the distance between the actual development levels of a student and the potential development level of the student (Gillani, 2003). When provided with appropriate learning tools and opportunities the student moves up a level of development or achievement to another in a cyclical fashion as more learning occurs.

ZPD is used in contemporary educational theories in three contexts. The first explains the emerging psychological functions of a child. The second is in relation to application, ZPD explains the difference between a student's independent and aided learning. Lastly, ZPD is used as a metaphoric "space" where every day concepts of the child meet the educational concepts that teachers or other instructors mediate or facilitate to grow the child's knowledge.

The Vygotskian perspective postulates the goal of education is to keep learners in their own ZPD as often as possible. This is achieved by giving the learners something that is of interest and meaningful in conjunction with problem-solving tasks that are slightly more challenging than what they can do alone. The challenging task involves working together in student groups or with a teacher or adult to guide the task until completion. The premise is that

once the learner has completed the task with another person, they can generalize the skill to be able to complete the task independently in the future; hence, the student's ZPD for that task has been raised. Murray and Arroyo (2002) posit that keeping students in their ZPD prevents them from being bored, confused, or frustrated, as these feelings can lead to distraction and culminate with lack of motivation.

Vygotsky developed the concept of ZPD as a criticism of an alternative to IQ testing, which he considered static individual testing. He asserts that static assessment tests, like IQ, measure operational knowledge that has already occurred and fossilized (fixed; Vygotsky, 1978). Vygotsky (1998) asserts, "A true diagnosis must provide an explanation, prediction, and scientific basis for practical prescription" (p. 205). The formulation of ZPD was to understand the student's current state of development to establish learning goals, identification of interventions needed to meet the learning goals, and create instructional groupings among the students. Vygotsky clearly posits that assessment and instruction are conjoined elements of the same dialectical activity. Poehner and Lantolf (2003) summarize that to fully assess students' development, it is insufficient to only consider intrapsychological ability; the interpsychological capacity must be a factor when determining students' development or achievement.

Measurement of Academic Progress

As students enter into kindergarten in SAPS, they are administered the MAP assessment. The results of the MAP are used to make educational placement decisions for each student. The MAP is also utilized in SAPS to assess students' learning over time. It is administered to every student in grades kindergarten through tenth grade at the beginning of each school year and at least two more times during the school year. Although the MAP is an online assessment and socialization skills are not part of the assessment, the MAP operationalizes the theories of

Vygotsky. The design of the MAP is to assess students' knowledge in their ZPD. Once current knowledge is established, a learning goal is generated for each student. The goal is the expected achievement of each individual student by the end of the school year in which the assessment is given. The intricacies of MAP are an important factor in this study. Further details about MAP are in the Instrumentation section of this paper.

<div align="center">**Alfred Bandura and Self-Efficacy**</div>

Alfred Bandura and Vygotsky share many foundational beliefs in the importance of non-cognitive skills, learning, and student achievement. Bandura's theory, known as the social cognitive theory, posits social factors combine with internal cognitive-motivational factors to explain learning and achievement in educational and non-educational arenas. Marrying the work of Badura and Vygotsky, people work together based on shared beliefs about what they think they can accomplish and common goals they create to increase fulfillment in their lives.

At the heart of Bandura's theory is the concept of self-efficacy. Self-efficacy is defined as a belief in one's self, which leads to achievement of goals, motivation, and ultimately, success (Bandura, 1997). Self-efficacy theory has been investigated in many academic arenas, demonstrating that belief in competence can influence motivation, effort, and persistence (Bandura, 1986). Bandura's studies established that self-efficacy affects a person's interests, persistence, and effort (Bandura, 1977). Bandura (1986) further affirmed that once a strong sense of self-efficacy is established, few obstacles will deter success and, conversely, any failure can be conquered.

There are four sources attributed to the increase in self-efficacy in students. Mastery experience is learning from own experiences. Self-efficacy is increased when a task is mastered independently. The second relates to students watching others, as role models, complete a task

with success and then believe that they, too, can have the same success. This relates to

Vygotsky's belief of the importance of watching others complete a task before a student is ready

to attempt it independently. The third source is the social persuasion received from others when

the student sees the benefits the others receive when they put forth effort and persist until success

is reached. The fourth is from the emotional and physiological state in which strong emotional

reactions to a task stimulate expectancy of success or failure. Positive emotions can increase

confidence, but stress or anxiety will result in poor functioning. In the classroom, if a student has

strong self-efficacy, he/she are more likely to start and complete a task with success. This

success then breeds success as the student's self-efficacy increases, he/she are more confident to

start a task and the cycle continues. This positive feedback loop is that of motivation.

Similar to TM and grit, self-efficacy can be taught within the classroom. A meta-analysis

of research conducted by Dignath et al. (2008) investigated if teaching self-regulation skills to

students in an elementary school had an effect on four-core content areas: reading, writing,

mathematics, and science. The conclusion of the meta-analysis of the research, which included

48 studies, established that self-regulation training produced a weighted effect size of 0.62 on

academic performance.

The 48 studies included in the above named body of research utilized various strategies to

teach self-regulation skills. The research further postulated that even if students are not explicitly

taught learning strategies, they are still able to realize the strategies by personal trial and error or

by watching others apply the strategy. Winne (1996, 1997) describes the process of learning

from observation as "bootstrapping," which follows the belief of social-cognitive theory.

CHAPTER III: METHODS

Introduction

The core purpose of the study was to investigate the relationship between grit, academic growth, and achievement in reading and mathematics scores as students progressed from kindergarten to second grade. The methods for this study are described in this chapter. The chapter includes research design, subject selection, instrumentation, data collection, and data analysis. The research is data based and was driven by the following questions:

1   Is there a significant positive correlation in the increase in reading achievement scores between kindergarten and second grade students who have higher levels of grit than those who have lower levels of grit?

2   Is there a significant positive correlation in the increase in mathematics achievement scores between kindergarten and second grade students who have higher levels of grit than those who have lower levels of grit?

3   How do grit and kindergarten Measurement of Academic Progress (MAP) entrance scores compare as performance predictors for second grade students' mathematics and reading scores?

4   Does gender, age at kindergarten entry and socioeconomic status correlate with students' grit scores?

Research Design

A quantitative approach using a correlational design was utilized to investigate the relationship between grit and academic achievement scores in reading and mathematics of second grade students. A quantitative model was employed to collect, analyze, interpret, and synthesize quantitative data. A correlational design utilizes associational statistics to identify a

relationship between two variables. The investigation of relationships between two variables (bivariate) or multivariate (three or more variables), is quantified through correlations (Vogt, 2007). This study was designed to explore the relationship between the independent variable, grit, and student academic growth and achievement.

Subject Selection

The subjects for this study consisted of students enrolled in second grade in one of the three elementary schools within the Sault Ste. Marie Area Public Schools (SAPS) during the 2017-2018 school year. SAPS is a rural district situated on the northeastern end of Michigan's Upper Peninsula, on the Canada–US border. Based on the 2016 census, the population of Sault Ste. Marie is just over 13,000 people. The per capita income is $21,957, which includes all adults and children. The median household income is $37,419. The population is comprised of 78% white and 18% Native American, which demonstrates the area is not racially diverse. The largest non-government employer in Sault Ste. Marie is the Sault Tribe of Chippewa Indians. The largest government employer is the local hospital, War Memorial Hospital. The second and third largest government employers in the area are Department of Corrections (two prison facilities) and education entities (Lake Superior State University and SAPS).

The geographic area of SAPS makes the district unique. The district encompasses 308 square miles and includes two islands. The large geographic area requires more than 70% of the district's students to receive district-provided busing, with an average ride time of 25 minutes. The district has experienced declining enrollment for the past 10 years. It is projected that the enrollment trend is likely to continue over the next five years. Currently, there are 2,200 K-12 students enrolled in the district. The district houses one (9-12) high school, one (9-12) alternative high school, one (6-8) middle school and three (K-5) elementary schools. Each K-5 elementary

school houses two classrooms per grade level. Each of the classrooms across the district is similar in class size, overall student achievement, socioeconomic distribution, race, and gender. Based on the Mi School Data site (most recent confirmed data is for 2017-2018 school year), there were 128 students enrolled in second grade across the district. Of these 128 students, 36 (28%) were Native American, 83 (65%) were White, 2 (1%) were Asian, 5 (4%) were African American, and 1(< 1%) were Hispanic/Latino. The students who were in second grade during the 2017-2018 school were the target population for this research study.

The official student count for the school year (2017-2018) confirmed an enrollment of 128 students in second grade in SAPS. The chosen sample for this study did not include all 128 enrolled second grade students due to the following factors. The research focused on the second grade students who had been continuously enrolled in SAPS since the 2015-2016 school year. This restriction was selected because these students were administered the MAP prior to entering kindergarten and would have taken the MAP at least two times each school year in kindergarten, first grade and second grade. This select sample encompassed students who attended junior kindergarten during the 2014-2015 school year; however, these students did not take the MAP until entry into kindergarten for the 2015-2016 school year. When all of the above factors were applied, the total sample of students targeted for this research was 96, which was 75% of the entire second grade population for SAPS. The sample was further reduced due the lack of written parental consent for 20 students. The final number of the sample for this research was 76, which was 79% of the targeted students for this research. The district's second grade student profiles and study sample are summarized in Table 1 (MiSchool Data, 2018).

Table 1

2017-2018 Demographics of Sault Ste. Marie Area Schools

Student Information	District Population	2nd Grade Population	Sample Group
Student Count	2171	128	76
Gender	Males 1149 (53%) Females 1022 (47%)	Males 67 (52%) Females 61(48%)	Males 38 (50%) Females 38 (50%)
White	59%	65%	72%
Native American	37%	28%	22%
Asian	1%	2%	1%
African American	1%	4%	4%
Hispanic/Latino	< 1%	< 1%	< 1%
Economically Disadvantaged	54%	62%	58%
Students with Disabilities	14%	13%	12%

In addition to the student subjects, there were six second grade teachers invited to participate in this research. They had two roles: to assist with the dissemination of the parental consent forms and to complete the Grit-S for each of the second grade students in their class. When someone completes a Grit-S for another person, Duckworth and Quinn (2008) coined him or her an "informant."

The informants for this research included six second grade teachers within three elementary schools in the SAPS district. There were informants in each of the three elementary schools. All of the informants were female veteran teachers. The range of teaching experience of the informants was 7 to 37 years, with the average for the six informants as 23.3 years of teaching experience.

Four of the six informants previously taught special education within SAPS prior to teaching second grade. Of the four teachers who previously taught special education, two of them taught special education preschool, and the other two taught special education at the elementary level. The remaining two informants previously taught kindergarten within SAPS for multiple years prior to teaching to second grade. Four of the six informants have taught second grade for more than eight years, and two of the six have taught second grade less than five years.

Instrumentation

This quantitative study utilized information from multiple data collection sources, each with a unique purpose. Collectively, they provided the data needed to address the requisites of the study. Illuminate Education provided the needed demographic information and the achievement information was mined from Northwest Evaluation Association (NWEA) using the students' progress report (Appendix A). The instrument used for the non-cognitive component was the Grit-S Survey (Appendix B). Each instrument utilized is explained in detail in the following paragraphs.

The student information system (SIS) utilized in SAPS is Illuminate Education. The Eastern Upper Peninsula Intermediate School District (EUPISD) has committed the use of Illuminate Education for all the districts within the EUPISD. The EUPISD holds the contract with Illuminate Education and all of the local education agencies (LEAs) within the EUPISD share expenses on a per pupil basis.

All student demographic information needed for this study was generated from Illuminate Education. Illuminate Education houses the district's most up-to-date student information as well as many other features pertinent to data collection for day-to-day operations of a district. Illuminate Education allows the quick draw of detailed reports for any kind of student

demographic, special education, health, or language information. Development of course schedules, mass scheduling, block scheduling, linked sections, student constraints, and course requests are easily created in Illuminate Education. It can also create and distribute custom transcripts and traditional and/or elementary standards-based report cards. The district uses Illuminate Education to aggregate various school data into one interface to enter, manage, view, and build reports. Customized reports can be generated; however, there are extensive and convenient pre-built, sharable reports: grades, standards, demographics, attendance, behavior incidents, student progress, and special education or health needs, which can be generated at the individual student, class, school, or district level.

The Measures of Academic Progress (MAP) Suite created by Northwest Evaluation Association (NWEA) is an online assessment system that is designed to support growth and skill mastery in students. It is designed to provide a thorough picture of student learning. The purpose-built measures define learning needs for groups and individual students within a classroom. It gives teachers an efficient means to diagnose student needs, make instructional decisions, and determine differentiated instruction needed for the class. The full MAP Suite includes three separate types of assessment systems: MAP Growth, MAP Reading Fluency, and MAP Skills.

The MAP Growth is designed to be administered up to three times per year to gain an accurate picture of how much a student has grown over time. MAP Growth provides provisions for individual goal setting for each student by defining what a student knows and what they are ready to learn.

The MAP Reading Fluency is a 20 minute quick assessment for kindergarten through third grade readers that measures oral reading fluency, foundational skills, and reading comprehension. This assessment allows group testing and automatic scoring return.

The MAP Skills is designed for skill mastery and progress monitoring. MAP Skills can be administered as often as needed to further refine and fill in any skill gaps a student may demonstrate. MAP Skills are given in between the MAP Growth assessments.

All three MAP assessment systems are designed to complement each other when used in conjunction; however, each assessment system can be a stand-alone assessment system. Districts have the option of choosing which assessment system meets the needs of the district or purchasing the MAP Suite complete assessment system.

For the purposes of this research study, the MAP Growth assessment system was the assessment utilized. The MAP growth assessment is what SAPS has chosen to provide student growth and achievement information for students in Grades K-10. This system has been utilized in the district since school year 2014-2015.

To better understand how this researcher used MAP Growth, a deeper understanding of this assessment system is needed. Although MAP Growth encompasses assessments for mathematics, reading, language usage, and science, this research will only focus on mathematics and reading assessments. MAP Growth is a computer adaptive assessment that begins with a test question appropriate for the student's grade level then adapts the test questions based on the responses to each question. This model of question predictability is called item response theory (IRT). Georg Rasch, a Danish mathematician, created IRT model. This sophisticated continuous refinement, as the student progresses through the assessment, allows the teacher to pinpoint

individual student needs whether there is a need for remediation or enrichment. This allows the teacher to use the data to inform instruction and track growth over time.

Within the MAP Growth system, there are assessments designed for specific grade level spans. For the purposes of this research, the focus was on MAP for Primary Grades (MPG) assessments. These assessments measure achievement in reading and mathematics for students in kindergarten to the end of second grade. The tests include multiple-choice questions and other types of questions to get a clear picture of student capabilities.

The MPG Screening Tests are used as part of the kindergarten enrollment process for SAPS. The series of tests are divided into two content areas with three skill areas: Mathematics Early Numeracy (counting, numbers, and computation) and Reading Early Literacy (phonological awareness, visual discrimination/phonics, and concepts of print). Each of the three skill areas are further broken down into three sub-skill areas for a total of 35 questions for Mathematics Early Numeracy and 33 questions for Reading Early Literacy.

The test adapts the testing path of each student based on the responses to the first half of the questions in each of the skill areas. The first 15 questions (five from each skill area) are in the intermediate skill range. The number of correct responses determines the path of the next set of questions, either more difficult or less difficult. The IRT path is individualized for each test taker; therefore, students are assessed at their zone of proximal development, which is more likely to provide a precise picture of the student's strengths and needs.

The MAP Growth assessment is given three times per year: fall, winter, and spring. There are defined testing windows established to ensure growth can be accurately calculated and standardized. The fall testing window is September, the winter testing window starts the latter part of December and ends mid-January, and the spring window is May through the first week in

June. Students take this assessment individually at a computer station. Since the questions are random and the testing path is different for each student, based on the IRT model, it is safe to assume students cannot share answers to questions. The scores from the assessments are available instantaneously to both the student and the teacher. The student report for MAP is very sophisticated and informative for the teacher while being celebratory for the student. Since this assessment is completed with a whole class at one time with each student at a computer station, it is difficult for the one teacher in the room to watch every detail of each student while each student takes the test. One helpful tool of the MAP assessment is the assessment time tracking. This tool allows a teacher to see how many minutes a student took on a particular assessment. If the time does not seem to be within a reasonable range, as compared to the other students in the class or compared to the student's previous MAP assessments, the teacher can determine if a student rushed through an assessment or simply clicked answers. This is important for the teacher to know to determine if the assessment provides an accurate reflection of the student's abilities.

The students' level of achievement in each subject tested is reported by using the NWEA's Rasch Unit Scale (RIT). The student's RIT score indicates the level at which the student answers questions correctly 50% of the time. The student's particular RIT score is the instructional level of this student, meaning it is their zone of proximal development. Once the RIT score is established, reports from NWEA provide a suggested learning path or parameters for setting appropriate goals for the student.

The RIT scales have characteristics that make them a viable scale for quantifying student achievement. They have proven to be stable within the equal interval scales that use individual item difficulty values to measure student achievement across grade levels. *Equal interval* means

it adjusts to the achievement of the student, regardless of the testing path established at the individual student level as all intervals are the same. *Stable* means comparisons can be made from student to student or from the scores on the same student during various test sessions. The meaning of the RIT score is constant across grade and age of students. There are "typical" RIT scores for each grade level, but every student is different. The RIT scale allows students to be accurately measured regardless of their grade level. All of the above stated characteristics of a RIT score make it a useful tool to show student growth over time as well as establishing appropriate current learning goals for the student.

To date, NWEA has RIT scales established for reading, language, mathematics, and general science. In their continuous effort to improve, NWEA is working towards developing other RIT scales for other content areas.

In addition to RIT scores on NWEA reports, percentile rankings are also provided. The percentile rankings are based on normative data from the most recent (2015) norms study. This additional data set allows for the comparison of a student's RIT score with other students in the same grade and subject.

NWEA is nationally normed based on anonymous assessment data from over 10.2 million students. The 2015 NWEA Norms Study is based on grade level samples of at least twenty thousand students per grade (kindergarten through eleventh grade). These records were based on a random draw of test records from 5.1 million students across the United States in a study completed in 2011 and again in 2015. Post-stratification procedures were used to ensure valid representation of the school-aged population in the country. Norm studies were completed for every grade level, every subject, and for each suggested test cycle (typically three times per

year). The extensive and sophisticated norm studies give teachers access to compare their

students' performance against national norm grade level mean and district grade level mean.

Duckworth et. al., (2007) define grit as, perseverance and passion for long-term goals;

they establish that grit predicted achievement in challenging domains over and beyond measures

of talent. Through constructing of the definition of grit came the research to determine how to

measure grit. The original Grit Scale (Duckworth et. al., 2007) was developed in 2007 as a 27-

question grit scale. First implementation of the original 27-item scale used a sample of 1,545

adults with a mean age of 45. Following an item analysis of this original study, the scale was

reduced to 17 items. An exploratory factor analysis (EFA) was completed using 772 of the

original 1,545 subjects. Due to the results of the EFA, five of the 17 items were eliminated. The

12 remaining items were grouped into two categories: Consistency of Interest and Perseverance

of Effort. Using the remaining 773 subjects from the original 1,545, Duckworth and her

colleagues used a confirmatory factor analysis (CFA) of a two-factor model. The results showed

support for the two-factor solution, with comparative fit index (CFI) = .83 and root mean square

error of approximation (RMSEA) = .11. It was through these series of analysis of the results that

the 12-item grit scale (Grit-O) was founded as a measure of grit.

In 2009, Duckworth and Quinn made efforts to further refine the 12-item grit scale. The

result of their efforts was the 8-item Short Grit Scale (Grit-S). Duckworth et al. conducted six

studies centered on determining the predictive validity of Grit-S. Study 1 used the similar sample

and design as the original study for the Grit-O. In Study 2, the CFA was used to test the two-

factor structure of the Grit-S. This study used a random sampling of adults to compare the

relationships between the following: Grit-S, Grit-O, and the Big Five personality dimensions as

they pertain to predictive validity for career changes and advanced education. The focus of Study

3 was to establish the validity of the informant version of the Grit-S. Stability over time was established using a sample of adolescents in Study 4. Study 5 tested predictive validity using West Point cadets while Study 6 tested predictive validity using National Spelling Bee finalists. All of the studies supported the predictive validity of Grit-S.

This researcher drew upon the information of Study 3, as this study involved the collection of grit scores by way of informants. Each of the second grade classroom teachers were the informants for the students in their classes. The findings of Study 3 determined reliability could be established by informants. The correlations between the self-reported version and informant version were r = .45, *p* < .001 and *r* = .47, *p* < .001, which are considered medium to large (Duckworth & Quinn 2008). Although none of the grit studies conducted to date have included an early elementary student population, grit shows potential to improve students' academic success.

The grit scales developed by Duckworth and her colleagues have had consistent reliability of .80 in demonstrating grit as a predictor of retention of a career goal or goal leading to life success in various populations (Duckworth, et. al., 2007; Duckworth & Quinn, 2009, & Strayhorn, 2013). Cronbach's coefficient alpha (Crocker & Algina, 1986) has been used to evaluate the internal consistency of the 8-item Grit Scale with a score of 0.64. This scale used a 5-point Likert-type scale ranging from one to five. Scores of one means very low level of grit, while a score of five means very high level of grit. Grit scores are computed using the following scale: positively stated questions (Questions 1,3,5 and 6), 1 = *very much like me*, 2 = *mostly like me*, 3 = *somewhat like me*, 4 = *not much like me*, or 5 = *not like me at all*. Negatively stated items will be reverse-coded (Questions 2, 4, 7 and 8): 5 = *very much like me*, 4 = *mostly like me,* 3 = *somewhat like me*, 2 = *not much like me*, 1 = *not like me at all*. All of the points are added

together, and the sum provides a raw score. The raw score is then divided by eight to calculate the subject's grit score. The maximum score on this scale is 5 (extremely gritty), and the lowest score on this scale is 1 (not at all gritty; Duckworth et. al., 2007).

For the purpose of this study, the Grit-S was modified from first person questions and responses to third person for questions and responses. This step was taken since the teacher of each subject was the person completing the Grit-S for each of the students in his/her current classroom. Appendix B is the original Grit-S and Appendix C is the modified Grit-S for the purpose of this study.

Data Collection

The first step in the data collection was be to gain approval of the superintendent of SAPS, Dr. Tim Hall, to utilize this researcher's access to Illuminate Education and NWEA for the purpose of data collection for this proposed study. Access to both data warehouses is password protected and available to each administrator in SAPS for instructional and teacher evaluation purposes. As a district administrator, this researcher has access to the data required for the proposed study; however, use for research purposes required special permission.

As a district level administrator, this researcher had district permissions to access student data through Illuminate Education and NWEA; however, additional permissions were sought and obtained through the Eastern Michigan University Human Subjects Review Committee (UHSRC), which is the institutional review board (IRB). These permissions were required since the information collected on each student was to be used for research purposes. The IRB approval letter can be found in Appendix D.

One of the requirements of the IRB was to obtain active parental permission for each of the student subjects. Although, no part of this research involved direct contact with the students,

the utilization of their demographic and achievement information for research purposes required a written consent of a parent or guardian for their child.

Parental permission was obtained by sending each student home with an Invitation to Participate packet, which included information about the research, a parent permission form, and a pre-labeled envelope for return of the permission form (Appendix E). The invitation to Participate packets were hand delivered by this researcher to each of the six second grade teachers in the SAPS district. The researcher met with each teacher to present them with an envelope containing an invitation to participate packet for each of their students, information about the research, informed consent for each teacher's participation (Appendix F) and copies of the GRIT-S survey for each student in their class. Directions were given to each teacher to complete the following: disseminate and collect the permission to participate forms, complete the GRIT-S for each student in their class, and return all of the materials to the researcher (Appendix G).

As the students returned the permission form, the teachers collected them and kept them in the envelope that was provided by the researcher. The teachers continued to collect the permission form from each student over several days. During this time, the teachers completed the GRIT-S survey for each student. Once the permission forms were collected and the GRIT-S surveys were complete, the researcher collected each of the envelopes from the teachers.

The initial attempt to obtain parental consent produced dismal results. A second attempt was made to obtain parental consent by the researcher attending and presenting the study information and the invitation to participate at a parents' open house at the schools. This method proved more successful. Between the two methods of obtaining parental consent, consent was obtained for 76 of the 96 potential student subjects. Of the 20 students where consent was not

obtained, there was only one who declined the invitation to participate; the other 19 did not respond. This researcher has determined the lack of parental consent for the 20 students did not affect the outcome of this study since the sample's demographic profile is consistent with the population's profile.

Once permission to access Illuminate Education for the purposes of this study was granted, a report of current students enrolled in second grade across the district was obtained through Illuminate Education. The report generated from Illuminate EducationMe included the student names, NWEA mathematics and reading scores from fall of 2015, and mathematics and reading scores from spring of 2018. A review of each student's enrollment history helped further define the subjects utilized for this study. Through a review of the enrollment history, only students who were continuously enrolled in SAPS since kindergarten (2015-2016 school year) were selected. All other student names were discarded. A spreadsheet was created listing the names of the students who were the final subjects of the study. The following student demographic information was collected for each subject using Illuminate Education: gender, socioeconomic status, race, birthdate, current age (in months), age at the time they entered kindergarten (in months), school attendance, and special education eligibility status.

The demographic information was pertinent to the study to obtain a clear picture of the relationship between grit and student achievement. A thorough investigation that breaks down each of the student demographic factors provided information leading to areas in need of further investigation. Gender was used to determine if there was a difference in academic growth both with and without the grit score. Since the majority of the subjects were either White or Native American, these two groups were considered when determining race as a correlate to student achievement and grit. The socioeconomic status was determined through designation of full pay,

free or reduced pay lunch status. The birthdate was be entered in month/day/year to be able to determine if the student was born in the first half of the year or second half of the year as this could be a factor when determining if maturation could affect the results of the study. Since part of this study was to investigate if attending junior kindergarten or repeating kindergarten has a relationship with student achievement in second grade, both with and without the grit score, the student's age in months at the time of kindergarten entry was warranted in the data collection. Student attendance and special education eligibility added an extra dimension to explore as having a relationship to grit and student achievement.

The MAP score collection included each student's MAP scores in reading and mathematics on the fall 2015 MAP when the student entered kindergarten and the spring 2018 MAP as the student ended second grade. The collected data focused on the composite MAP score in both mathematics and reading. In some cases, students took the MAP assessment more than one time during a particular assessment window. The MAP score utilized for the purposes of this research were the scores obtained by the student's final attempt at taking the MAP during that particular assessment window.

The perception data were collected using the Grit-S survey developed by Angela Duckworth. Each of the second grade teachers in SAPS were trained to complete the Grit-S survey for each student assigned to their second grade class who met the designated criteria for this research. A designated criterion for this study was if the student had been continuously enrolled in SAPS since 2015-2016 school year. The other criterion was the completion of the MAP assessment upon entering SAPS as a kindergarten student. This researcher prepared a modified GRIT-S survey for each student in each teacher's class. The Grit-S Survey was modified by changing the questions from being stated in first person to third person. This

modification was needed since the teachers, as the informants, were going to be completing the survey about the student as opposed to having the student complete their own survey. The researcher hand delivered the survey to each second grade teacher along with a letter about the study and instructions for completing the survey. An established date and procedure for the researcher to collect the completed surveys was stated in the letter.

Once the surveys were collected, a grit score for each student was calculated by using a 5-point scale based on a positively or negatively stated question. The values were established according to the following: positively stated questions (Questions 1, 3, 5 and 6), 1 = *very much like student*, 2 = *mostly like student*, 3 = *somewhat like student*, 4 = *not much like student*, or 5 = *not like student at all*. Negatively stated items will be reverse-coded (Questions 2, 4, 7 and 8): 5 = *very much like student*, 4 = *mostly like student*, 3 = *somewhat like student*, 2 = *not much like student,* 1 = not like student at all. After the research assigned points, all the points were added up and divided by eight. The scores ranged from 5 (*extremely gritty*) to 1 (*not at all gritty*; Duckworth et al., 2007). The grit scores of each subject were added to the spreadsheet of names, demographic information, and MAP scores. When the grit scores were recorded on the spreadsheet, both the raw score of the Grit-S Survey and the actual grit score (raw score divided by eight) were included. The grit score for the 76 subjects for this study ranged from 1.63-5.00 with a mean of 3.84, median of 3.94, mode of 5.0 and SD of .90.

Once the grit scores were added to the spreadsheet, the subject's names were removed and only a numerical list of the study subjects remained. Student names were not used or referred to for any part of the statistical analysis or survey results.

Data Analysis

The raw data were imported from an excel spreadsheet into the Statistical Package for the Social Sciences (SPSS). SPSS was used to manipulate and analyze the data using multiple variances and descriptors. Descriptive statistics in the form of frequency and percentage distribution tables were created. Pearson-Product Moment Correlation Coefficients (Field, 2013), normally denoted as *r* were used as a statistical value to measure the linear relationship between two variables.

Variables consisting of the difference between the student's current MAP RIT score (spring 2018) and the MAP RIT score when they entered kindergarten (fall 2015) were established for both mathematics and reading. A series of Pearson product-moment correlation coefficients (Field, 2013) were computed to examine the direction and magnitude of the bivariate associations between the grit scores and MAP reading and mathematics scores. Pearson r is a method for determining if a correlation exists between two independent variables. It generates a score between +1 and -1, which measures the extent of the relationship of two variables and whether that relationship is positive or negative. The greater the absolute value of the Pearson product-moment correlation Coefficient, the stronger the linear relationship. The strongest linear relationship is shown by a correlation coefficient of -1 or +1. The weakest linear relationship is shown by a correlation coefficient equal to 0. A positive correlation means that if one variable increases, the other variable tends to increase. A negative correlation means that if one variable increases, the other variable tends to decrease (Field, 2013). A one-tailed test is a statistical test in which the critical area of a distribution is one-sided so that it is either greater than or less than a certain value, but not both. A one-tailed test was the statistical test utilized for this study.

Since this research relied on ordinal data, interval data, and standardized scores, Pearson r was utilized to well measure the grit scores associated with changes in the performance of

students on the mathematics and reading MAP tests between kindergarten entry (fall 2015) and

the end of second grade (spring 2018). Student growth was measured using the difference

between the spring 2018 MAP scores and the fall 2015 MAP scores in both mathematics and

reading. Student achievement was measured using the MAP mathematics and reading scores at

each of the above named testing cycles. A series of Pearson-product moment correlation

coefficients (Field, 2013) was calculated to explore the direction and significance of the bivariate

relationship between grit scores, MAP growth scores, and MAP achievement scores. The

strength of the relationship was explained using the following scale: $0 - .3$ weak relationship,

$.31 - .5$ moderate relationship, and .5 or higher a strong relationship.

      The subjects were assigned into the variable groups using a one or two value factor. A

series of Pearson product-moment correlation coefficients (Field, 2013) were employed to allow

comparisons of multiple groups and variables. Table 2 demonstrates the value factors for each

group utilized for the series of analytics to generate the results of the study.

Table 2

Value Factor Categories

Category	Value 1	Value 2	Value 3
Gender	Male	Female	
Age in months September 2015	Younger 59-67	Older 68-81	
Race	White	Native American	Other
Socioeconomic Status	Full Pay lunch	Free/Reduced Lunch	
Attendance	Lower 65-94	Higher 95-99	

CHAPTER IV: RESULTS

Introduction

The purpose of this quantitative study was to test the hypothesis that academic growth on Measurement of Academic Progress (MAP) assessments of early elementary students in the areas of mathematics and reading are correlated to the student grit scores. This study included a Grit-S survey and Northwest Evaluation Association's (NWEA) MAP Rasch Unit Scale (RIT) scores in reading and mathematics of 176 students enrolled in second grade in a rural school district in the eastern upper peninsula of Michigan. Subject demographic information was collected from the student information system, Illuminate Education, which included gender, birthdate, socioeconomic status, retention, and attendance.

This study examined the following research questions:

1. Is there a significant positive correlation in the increase in reading achievement scores between kindergarten and second grade students who have higher levels of grit than those who have lower levels of grit?

2. Is there a significant positive correlation in the increase in mathematics achievement scores between kindergarten and second grade students who have higher levels of grit than those who have lower levels of grit?

3. How do grit and kindergarten MAP entrance scores compare as performance predictors for second grade students' mathematics and reading scores?

4. Does gender, age at kindergarten entry, and socioeconomic status correlate with students' grit scores?

This chapter will begin with an overview of the subjects involved in this study followed by a description of the instruments utilized. The next section will provide data tables and a

narrative explaining the frequency distribution of each category analyzed. The correlational analysis and group comparison analysis of the data are organized and presented in this chapter organized by the research questions in the third section. The final section of this chapter will summarize the findings and determine if the study provided answers to the guiding questions for this research.

Subjects' Profile

The subjects for this study consisted of students enrolled in second grade in one of the three elementary schools within the Sault Ste. Marie Area Public Schools (SAPS) during the 2017-2018 school year for whom written parental consent to participate in this research was provided. The full population of 128 second grade students was regressed to 76 subjects due to the following factors: the subjects were continuously enrolled in SAPS from the 2015-2016 school year until the end of the 2017-2018 school year, they completed the MAP assessments in reading and mathematics when entering kindergarten and exiting second grade, and parental consent was provided. The subjects consisted of 50% male and 50% female, 72% White, 22% Native American, 4% African American, 1% Asian, less the 1% Asian, 58% free or reduced lunch, and 12% eligible for special education. Table 2, shown previoulsy, summarizes and compares the subject group and population of SAPS students.

Quantitative Results

The subject group has little racial diversity with 72.5% White, 22.4% Native American, and 5% other. Initially, the statistics were calculated using the three categories named above. Further analysis was conducted reducing the categories to two categories by combining Native American and other as one category (2) and White as the other category (1). Table 3 demonstrates the initial race distributions.

Table 3

Race

	Frequency	Percent	Valid	Cumulative Percent
White	55	72.4	72.4	72.4
Native American	17	22.4	22.4	94.7
Other	4	5.3	5.3	100.0
Total	76	100.0	100.0	

n = 76

Gender included two categories, male and female. There was an equal distribution of male and female subjects. Males were coded as 1 and females were coded as 2. All 76 subjects were included in this variable as seen is Table 4

Table 4

Gender of Subjects

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	38	50.0	50.0	50.0
Female	38	50.0	50.0	100.0
Total	76	100.0	100.0	

n=76

The subjects' birthdates were calculated into months in age as of September 1, 2015. The rationale for this calculation was to consider the variable of how old the subject was when he/she entered kindergarten. This number included subjects who attended junior kindergarten or kindergarten during the 2014-2015 school year. Students who attended junior kindergarten were grouped with students who were retained in kindergarten. A criterion in the subject selection

included that of being enrolled in SAPS as a kindergarten student during the 2015-2016 school year; therefore, 100% of the subjects were part of this variable. The range was from 59 months to 81 months of age as of September 1, 2015. The mean age was 67.55 months. The subjects were divided into two groups: subjects who were 59–67 months of age as of September 1, 2015 were in the younger category (1). Subjects who were 68–81 months of age as of September 1, 2015 were in the older category (2) as shown in Table 5.

Table 5

Age in Months at Kindergarten Entry

	Age in Months
Valid	76
Missing	0
Mean	67.55
Median	68.00
Std. Deviation	5.325
Range	22

The socioeconomic status was based on lunch pay status of each of the subjects. Table 6 demonstrates the subject count based on full pay, reduced, or free lunch status. For the purposes of reducing the categories to two for the data analysis, reduced pay status and free status were combined. The two categories were full pay status (1) and free/reduced pay status (2). Table 7 demonstrates the results by categories.

Table 6

Socioeconomic Status/Lunch Pay Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Free Lunch	38	50.1	49.3	49.3
	Reduced Lunch	6	7.9	8.0	57.3
	Not Eligible	32	42.1	42.7	100.0
	Total	76	98.7	100.0	
Missing	System		0.0		
	Total	76	100.0		

n = 76

Table 7

Socioeconomic Status Two Categories, n=76

	Frequency	Percent	Valid Percent	Cumulative Percent
Lower	44	57.9	57.3	57.3
Higher	32	42.1	42.7	100.0
Total	76	98.7	100.0	
Missing System	0	1.3		
Total	76	100.0		

n = 76

Attendance records, as reported in percentage of days present, were obtained for each of the subjects for the 2015-2016 school year through the 2017-2018 school year. An average of the days present in school was calculated for each subject for the three-year period as shown in Table 8.

Table 8

Average School Attendance

	Average School Attendance
Valid	76
Missing	0
Mean	94.08
Median	95.00
Std. Deviation	4.439
Range	34

n = 76

A median score was used to create two categories of school attendance. Subjects who attended on average between 65-94% of the time were categorized as lower (1). Subjects who attended on average between 95-99% of the time were categorized as higher (2) as shown in Table 9.

Table 9

Attendance Two Categories

	Frequency	Percent	Valid Percent	Cumulative Percent
Lower	30	39.5	39.5	39.5
Higher	46	60.5	60.5	100.0
Total	76	100.0	100.0	

n = 76

Duckworth et. al., (2007) defined grit as perseverance and passion for long-term goals, they established that grit predicted achievement in challenging domains over and beyond measures of talent. Through the construction of the definition of grit came the research to determine how to measure grit. The original Grit Scale (Duckworth et. al., 2007) was developed in 2007 as a 27-question grit scale. First implementation of the original 27-item scale used a sample of 1,545 adults with a mean age of 45. Following an item analysis of this original study, the scale was reduced to 17 items. An exploratory factor analysis (EFA) was completed using 772 of the original 1,545 subjects. Due to the results of the EFA, five of the 17 items were eliminated. The 12 remaining items were grouped into two categories: Consistency of Interest and Perseverance of Effort. Using the remaining 773 subjects from the original 1,545, Duckworth and her colleagues used a confirmatory factor analysis (CFA) of a two-factor model. The results showed support for the two-factor solution, with comparative fit index (CFI) = .83 and root mean square error of approximation (RMSEA) = .11. It was through these series of analysis of the results that the 12-item grit scale (Grit-O) was founded as a measure of grit.

In 2009, Duckworth and Quinn made efforts to further refine the 12-item grit scale. The result of their efforts was the 8-item Short Grit Scale (Grit-S). It is the Grit-S that was used for this study. An informant (subject's teacher) for each of the subjects completed the grit scale. The grit scale is comprised of eight items, each item response is based on a 5-point scale; a maximum raw grit score would be 40. The actual grit score for each student is the raw score divided by eight. The subjects' raw and actual grit scores are summarized in Table 10.

Table 10

Summary of Grit-S Scores

	Grit-S 1 Raw Score	Grit-S 2 Actual Score
Valid	76	76
Missing	0	0
Mean	30.67	3.83388
Median	31.50	3.93750
Std. Deviation	7.199	.899858
Range	27	3.375

n = 76

The Measures of Academic Progress (MAP) Suite created by Northwest Evaluation Association (NWEA) is an online assessment system designed to support growth and skill mastery in students. It is designed to provide a thorough picture of student learning. The purpose built measures define learning needs for groups and individual students within a classroom. It gives teachers an efficient means to diagnose student needs, make instructional decisions, and determine differentiated instruction needed for the class. The full MAP Suite includes three separate types of assessment systems: MAP Growth, MAP Reading Fluency, and MAP Skills.

The MAP Growth is designed to administer up to three times per year to gain an accurate picture of how much a student has grown over time. MAP Growth provides provisions for individual goal setting for each student by defining what a student knows and what they are ready to learn. There are defined testing windows established to ensure growth can be accurately calculated and standardized. The fall testing window is September, the winter testing window starts the latter part of December and ends mid-January and the spring window is May through the first week in June.

Each student's achievement scores are reported by NWEA using a RIT score. The RIT scores provide a suggested learning path for establishing appropriate learning goals for the student. The RIT scores are designed to keep the student in his/her zone of proximal development as the RIT score represents the level where students correctly answered the assessment questions on his/her individualized testing path 50% of the time. The results of the assessment path and the RIT scores establish the student's instructional level.

The characteristics of the RIT scales make them a viable scale for quantifying student achievement. They have proven to be stable within the equal interval scales that use individual item difficulty values to measure student achievement across grade levels. *Equal interval* means all intervals are the same. As a student moves through the assessment, it automatically adjusts to the achievement level of the individual student. *Stable* means comparisons can be made at the individual student level, class level, and grade level per test session, or across various test sessions. The value of the RIT score is constant across grade and age of students. There are *typical* RIT scores established for each grade level. These typical scores are helpful for comparisons at the individual student or group levels. The RIT scale allows students to be accurately measured across multiple grade levels. All of the above stated characteristics of a RIT score make it a good tool to show student growth over time as well as establishing appropriate current learning goals for the student.

The summary of the subjects RIT scores for both mathematics and reading are shown in Tables 11 and 12 respectively. The final column of the summary of RIT score tables is the difference in the subjects' RIT scores for spring 2018 and fall 2015. This difference was calculated to determine the subject's achievement growth from fall 2015 to the spring 2017.

Table 11

Summary of NWEA MAP Mathematics RIT Scores

	2015-2016 NWEA Math Fall Test RIT Score	2017-2018 NWEA Math Spring Test RIT Score	Mathematics RIT Scores Difference, Spring 2018-Fall 2015
Valid	76	76	76
Missing	0	0	0
Mean	139.68	197.04	57.36
Median	137.50	198.00	57.50
Std. Deviation	12.160	13.711	13.563
Range	53	75	70

Table 12

Summary of NWEA MAT RIT Reading Scores

	2015-2016 NWEA Reading Fall Test RIT Score	2017-2018 NWEA Reading Spring Test RIT Score	Reading RIT Scores Difference, Spring 2018-Fall 2015
Valid	76	76	76
Missing	0	0	0
Mean	140.74	193.62	52.88
Median	141.00	197.00	54.00
Std. Deviation	10.129	12.946	13.563
Range	55	62	70

The first research question was *Is there a significant positive correlation in the increase*

in reading achievement scores between kindergarten and second grade students who have higher

levels of grit than those who have lower levels of grit? In order to respond to this question, the

researcher used the difference between the subjects' spring 2018 reading MAP RIT score and the reading MAP RIT score from kindergarten entry in fall 2015. A series of Pearson product-moment correlation coefficient (Field, 2013) were computed to examine the direction and magnitude of the bivariate associations between the grit scores and MAP reading scores.

Pearson r is a method for determining if a correlation exists between independent variable. It generates a score between +1 and -1, which measures the extent of the relationship of two variables and whether that relationship is positive or negative. Since this research relies on ordinal data and standardized scores, it will use Pearson r to well measure the amount of change in grit scores as associated with changes in student performance on the reading MAP tests between kindergarten and second grade.

Table 13

Correlation of Grit Score Relationship to Reading RIT Score Difference

		Reading RIT Score Difference
GRIT Actual Score	Pearson Correlation	.318[**]
	Sig. (1-tailed)	.003
	N	76

**Correlation is significant at the 0.01 level (1-tailed)

Table 13 demonstrates there was a significant weak to moderate relationship between the subjects' grit score and their growth in reading achievement as measured by the difference between the spring 2018 RIT score and fall 2015 RIT scores when using the actual grit score and the actual RIT scores of the subjects.

Based on the analytic measure, there is evidence to support a significant positive relationship between the increase in reading achievement scores between kindergarten and second grade students who have higher levels of grit than those who have lower levels of grit.

The second research question was *Is there a significant positive correlation in the increase in mathematics achievement scores between kindergarten and second grade students who have higher levels of grit than those who have lower levels of grit?* In order to respond to this question, the researcher used the difference between the subjects' spring 2018 mathematics MAP RIT score and the mathematics MAP RIT score when entering kindergarten, fall 2015. A series of Pearson product-moment correlation coefficient (Field, 2013) were computed to examine the direction and magnitude of the bivariate associations between the grit scores and MAP reading scores.

Pearson r is a method for determining if a correlation exists between independent variable. It generates a score between +1 and -1, which measures the extent of the relationship of two variables and whether that relationship is positive or negative. Since this research relies on ordinal data and standardized scores, it will use Pearson r to well measure the amount of change in grit scores as associated with changes in the performance of students on the reading MAP tests between kindergarten and second grade.

Table 14

Correlation of Grit Score Relationship to Mathematics RIT Score Difference, n=76

		MAP Math RIT Score Difference
GRIT Actual Score Two	Pearson Correlation	.254[**]
	Sig. (1-tailed)	.014
	N	76

 **Correlation is significant at the 0.01 level (1-tailed)

Table 14 demonstrates when using the actual grit score and the actual RIT scores of the subjects, there was a positive significant weak relationship between the subjects' grit score and

their growth in mathematic achievement as measured by the difference between their

mathematics spring 2018 RIT score and fall 2015 RIT score.

Based on analytic measure, there is evidence to support a weak positive relationship that

is somewhat significant between the increase in math achievement scores between kindergarten

and second grade subjects who have higher levels of grit than those who have lower levels of

grit.

Table 15 combines the information from questions one and two in one data set. In

addition to a significant positive relationship found between the subjects' grit score and math and

reading improvement, a highly significant moderate to strong relationship was established

between the growth in reading and mathematics. This means the amount of improvement a

student made between kindergarten and second grade was relatively equal between reading and

mathematics.

Table 15

Summary of Grit Score and Academic Growth

		GRIT1	Read RIT Score Difference	Math RIT Score Difference
GRIT1	Pearson Correlation	1	.318**	.254*
	Sig. (1-tailed)		.003	.014
	N	76	76	76
Read RIT Score Dif.	Pearson Correlation	.318**	1	.471**
	Sig. (1-tailed)	.003		.000
	N	76	76	76
Math RIT Score Dif.	Pearson Correlation	.254*	.471**	1
	Sig. (1-tailed)	.014	.000	
	N	76	76	76

*Correlation is significant at the 0.05 level (1-tailed)
**Correlation is significant at the 0.01 level (1-tailed)

The third question was *How do grit and kindergarten MAP entrance scores compare as performance predictors for second grade students' mathematics and reading scores?* In order to respond to this question, the researcher used the subjects' fall 2015 and spring 2018 mathematics MAP RIT scores and the fall 2015 and spring 2018 reading MAP RIT scores. The fall 2015 MAP RIT scores were gathered the first month the subjects were enrolled in kindergarten in the fall of 2015. The spring scores were obtained from the math and reading MAP RIT scores from the spring 2018 test administration when the subjects were concluding second grade.

A series of Pearson product-moment correlation coefficient (Field, 2013) were computed to examine the direction and magnitude of the bivariate associations between the grit scores and MAP reading scores. Pearson r is a method for determining if a correlation exists between independent variable. It generates a score between +1 and -1, which measures the extent of the relationship of two variables and whether that relationship is positive or negative. Since this research relies on ordinal data and standardized scores, it will use Pearson r to well measure the amount of change in grit scores as associated with changes in student performance on the reading and mathematics MAP tests between kindergarten and second grade.

Tables 16 and 17 demonstrates a highly significant, strong positive relationship exists between grit scores and 2018 spring MAP scores in both reading and math. Additionally, the relationship between grit scores and 2015 fall RIT scores is moderate with significance.

Table 16

Correlation of Mathematics Fall 2015 and Spring 2018 RIT Scores

		2015 Math Fall Test RIT Score	2018 Math Spring Test RIT Score
GRIT Actual Score	Pearson Correlation	.365[*]	.507[**]
	Sig. (1-tailed)	.001	.000
	N	76	76

*Correlation is significant at the 0.05 level (1-tailed)
**Correlation is significant at the 0.01 level (1-tailed)

Table 17

Correlation of Reading Fall 2015 and Spring 2018 RIT Scores

		2015 Reading Fall Test RIT Score	2018 Reading Spring Test RIT Score
GRIT Actual Score	Pearson Correlation	.222[*]	.549[**]
	Sig. (1-tailed)	.027	.000
	N	76	76

*Correlation is significant at the 0.05 level (1-tailed)
**Correlation is significant at the 0.01 level (1-tailed)

Based on the statistical analysis performed, grit scores are not predictive. However, students with higher grit scores also have higher scores in both mathematics and reading when they exit second grade. As the students exited second grade, students who scored well in mathematics also performed well in reading, $r = .693$ $p > .000$ as demonstrated in Table 18.

Table 18

Summary of NWEA and Grit Scores

		2015-2016 NWEA Math Fall Test RIT Score	2015-2016 NWEA Reading Fall Test RIT Score	2017-2018 NWEA Reading Spring Test RIT Score	2017-2018 NWEA Math Fall Test RIT Score
2015-2016 NWEA Math Fall Test RIT Score	Pearson Correlation	1	.597[**]	.465[**]	.562[**]
	Sig. (1-tailed)		.000	.000	.000
	N	76	76	76	76
2015-2016 NWEA Reading Fall Test RIT Score	Pearson Correlation	.597[**]	1	.329[**]	.327[**]
	Sig. (1-tailed)	.000		.002	.002
	N	76	76	76	76
2017-2018 NWEA Math Spring Test RIT Score	Pearson Correlation	.562[**]	.327[**]	.693[**]	1
	Sig. (1-tailed)	.000	.002	.000	
	N	76	76	76	76
2017-2018 NWEA Reading Spring Test RIT Score	Pearson Correlation	.465[**]	.329[**]	1	.693[**]
	Sig. (1-tailed)	.000	.002		.000
	N	76	76	76	76
Grit Actual	Pearson Correlation	.365[**]	.222[*]	.507[**]	.549[**]
	Sig. (1-tailed)	.001	.027	.000	.000
	N	76	76	76	76

**Correlation is significant at the 0.01 level (1-tailed)
* Correlation is significant at the 0.05 level (1-tailed)

The fourth and final research questions was *how do race, gender, age at kindergarten entry and socioeconomic status correlate with grit scores?* In order to respond to this question this research called upon the categories established through the descriptive and frequency distribution information of each variable. Categories within each variable were computed using a series of Pearson product-moment correlation coefficient (Field, 2013) to examine the direction and magnitude of the bivariate associations between the grit scores and each variable: race, gender, age at kindergarten entry, and socioeconomic status. Table 19 demonstrates the associations of these variables.

Race and grit demonstrated a $r = -.161$, $p < .164$ which indicates relationship is very weak with strong significance. Therefore, no correlation between grit scores and race exists. The correlation for grit and gender demonstrated the same relative level of a very weak relationship with some significance at $r = .158$, $p < .056$ significance rating. There was also a very weak relationship between grit and age in months at kindergarten entry with some significance, $r = -.184$, $p < .056$. The final correlation study was socioeconomic status and grit. In this case, there was a moderate relationship that was highly significant, $r = .377$, $p < .000$). The results are captured in Table 19.

Table 19

Summary of Variable Correlations and Grit Scores

		Grit Actual	Race	Gender of Students	Attended Pre Kindergarten	Average School Attendance
Grit Actual	Pearson Correlation	1	-.154	.127	.196[*]	.403[**]
	Sig. (1-tailed)		.092	.137	.045	.000
	N	76	76	76	76	76
Race	Pearson Correlation	-.154	1	-.161	-.133	.000
	Sig. (1-tailed)	.092		.082	.126	.500
	N	76	76	76	76	76
Gender of Students	Pearson Correlation	.127	-.161	1	.095	-.006
	Sig. (1-tailed)	.137	.082		.208	.480
	N	76	76	76	76	76
Attended Pre KG	Pearson Correlation	.196[*]	-.133	.095	1	.124
	Sig. (1-tailed)	.045	.126	.208		.143
	N	76	76	76	76	76
Average School Attendance	Pearson Correlation	.403[**]	.000	-.006	.124	1
	Sig. (1-tailed)	.000	.500	.480	.143	
	N	76	76	76	76	76

**Correlation is significant at the 0.01 level (1-tailed)
* Correlation is significant at the 0.05 level (1-tailed)

Summary

The quantitative results of this study demonstrated that second graders with higher levels of grit had higher levels of achievement in both mathematics $r = .506, p < .000$ and reading $r = .549, p > .000$. Grit appeared to play a role in the subjects' achievement as they completed second grade in both mathematics and reading; however, there was also a highly significant moderate relationship found between grit and the increase in achievement between kindergarten and second grade in both mathematics $r = .254, p < .014$ and reading $r = .318, p < .003$. The strongest relationship found was between the subjects' RIT scores in mathematics and the RIT scores in reading $r = .693, p < .000$ as they completed second grade. There was a small but significant relationship found between grit and the subjects' mathematics or reading scores as they entered kindergarten, $r = .365, p < .001; r = .222, p < .027$, respectively.

Close review of the variables analyzed for this study substantiated there was minimal to moderate relationship between grit and any of the following variables: gender, race, age at kindergarten entry, or whether or not the subject attended junior kindergarten or was retained in kindergarten. The other two variables considered, socioeconomic status and school attendance, did demonstrate a positive relationship with grit. There was a strong relationship that was highly significant between grit and socioeconomic status $r = .446, p < .000$). The relationship between grit and school attendance was also a highly significant strong relationship $r = .403, p < .000$.

The extensive data analysis provided a clarity about the relationships between grit and student achievement over time. A deeper understanding of the relationship between mathematics and reading achievement as students move from kindergarten to second grade was also garnered as the results indicated the subjects were developing mathematic and reading skills at an equal rate.

CHAPTER V: DISCUSSION AND CONCLUSIONS

Introduction

Educators posit that how hard students work may be the single most common predictor of success (Tomlinson, 2013). Students who persevere when faced with challenges and adversity have grit (Duckworth et.al., 2007). This study aimed to determine if grit is a missing social-emotional factor when determining or predicting student achievement. Grit and other non-cognitive skills have the potential to be explicitly taught and fostered within learners of all ages which, in turn, enhances students' cognitive skills that leads to increased student achievement.

Studies of non-academic skills as measures of academic achievement are not new to the field of education. Psychologists have established non-cognitive skills as reliable, valid, measurable and strongly predictive of future outcomes decades ago (Bandura, 1977). This belief has resurfaced with the December 2015 Every Student Succeeds Act (ESSA). ESSA has sparked a newfound interest in the utilization of non-cognitive skills as measures of student success. ESSA requires states to include at least one non-academic measure in their accountability systems. ESSA also includes the provision of federal funding for the purpose of exploring, field-testing, and utilizing non-cognitive measures of student success or achievement.

The value of embracing non-cognitive skills as measure of student achievement is that skills such as grit and perseverance can be taught and developed in the classroom which, in turn, increases students' performance in all areas of academic achievement. The key is for educators to help students develop the necessary skills to deal with failure while strengthening their grit and perseverance.

Discussion

This quantitative study was proposed to delve into the relationship between grit and academic achievement. A review of the literature uncovered a significant number of studies about the relationship of grit and highly successful adults; however, no studies were found that considered the relationship between grit and young learners. This research was guided by the following questions:

1 Is there a significant positive correlation in the increase in reading achievement scores between kindergarten and second grade students who have higher levels of grit than those who have lower levels of grit?

2 Is there a significant positive correlation in the increase in mathematics achievement scores between kindergarten and second grade students who have higher levels of grit than those who have lower levels of grit?

3 How do grit and kindergarten MAP entrance scores compare as performance predictors for second grade students' mathematics and reading scores?

4 Does gender, age at kindergarten entry and socioeconomic status correlate with students' grit scores?

Alfred Bandura's (1977) social cognitive theory was the overarching umbrella for the theoretical framework for this study. Bandura posits that in order for learners to gain an understanding of what is to be learned, they must possess the motivation to stay on task and be engaged in their learning. The constructs that control factors of motivation and engagement in learning are referred to as self-regulation and self-efficacy (Bandura, 1977). Academic achievement is directly related to self-efficacy, as self-efficacy influences motivation, engagement, effort, and persistence. Under this theoretical frame umbrella are two related and

interdependent theories: Angela Duckworth's grit theory and Carol Dweck's theory of mindset. Angela Duckworth's grit theory is related to this study as a predictor of academic success. Duckworth's concept of grit posits if learners are motivated to set a goal for their learning and persevere until the goal is attained, they have grit. Carol Dweck's theory of mindset (TM) is the final piece to this theoretical frame. TM is the belief that in order for the most learning to occur, one must have a growth mindset, a belief that continual learning can take place over the span of life.

Applying this theoretical frame to classroom learning and academic success forces one to consider the belief that academic success is more than the measurement of cognitive skills. Equal attention must be given to the significant role non-cognitive skills play in a learner's academic success. Combining the theories of Bandura, Duckworth, and Dweck, one can surmise that a student may demonstrate cognitive skills as they enter the world of academia, but if those skills are going to be grown over time, the student must believe he/she can learn and he/she must have grit. Applying this theoretical frame, if a student starts school with limited cognitive skills but is motivated to learn, has grit, believes he/she can learn, and is provided instruction in their ZPD, the likeliness of academic growth and success is elevated exponentially.

The instrumentation chosen for this study have relevance to the theoretical frame. The research based NWEA MAP Growth assessments focus on keeping the students' learning path in their ZPD by using item response theory (IRT), which was created by Danish mathematician, Georg Rasch. MAP Growth is a computer adaptive assessment that begins with a test question appropriate for the student's grade level, and then adapts the test questions based on the responses to each question. This individualized assessment path created as the student progresses through the assessment, allows the teacher to pinpoint individual strengths and weaknesses and

establish where a student would benefit from remediation or enrichment. Teachers can utilize the information to inform instruction and track student growth over time.

The MAP further meshes with the theoretical frame with the goal setting practices utilized at the individual student level. The process of student goal setting, allows the student to take ownership of their learning, therefore enhancing their TM of striving for obtainable growth. A sample goal setting worksheet is shown in Appendix H (Northwest Evaluation Association, 2017b). The expectation for the teachers in SAPS is they hold goal setting meetings with each of their students after the fall (September) and winter (January) MAP assessments are administered.

The combination of the IRT process utilized as the students take the MAP Growth assessment coupled with goal setting, is the working model of Vygotsky's belief that in order to gain an understanding of the learning, the skill to be learned needs to be familiar to the student and scaffolded from the unfamiliar to the familiar. As the student moves through the MAP Growth assessment, the path of questions is determined based on the student's individual performance. This keeps the student in a learning that is familiar to them, therefore building confidence. The goal setting meetings that follow each assessment administration present the opportunity to discuss what was familiar to the student and the steps to take to move into new learning.

Being ready for the new learning encompasses TM and the growth mindset. Students need to believe they can learn in order to benefit from learning opportunities afforded to them. Dweck (2008) posits that students with a growth mindset try harder to overcome obstacles to learning and creates a way to improve. Tough (2012), brings together Dweck's TM and Duckworth's grit to conclude effort is more important that ability when considering academic achievement. Dweck's growth mindset makes the student ready for learning as the student

embarks on academic tasks, while Duckworth's grit makes the learner persevere through completion of the academic task, regardless of the difficulty or time for task completion.

The relationship between grit and academic achievement was the foundation of this study. The studies performed by Duckworth, which demonstrated the relationship of grit and achievement sparked this researcher's interest. Through a key study of Duckworth's in 2009, a consistent finding was, the students with the most grit were the most successful; however, those with the highest intelligence did not outperform those with higher grit with less intelligence.

Grit falls in the category of non-cognitive skills, which have resurfaced and moved to the forefront of student achievement since the coming of ESSA in 2015. Unlike the cognitive skill, IQ, non-cognitive skills are malleable; therefore, they can be taught and cultivated to grow students into successful learners. The more educators can learn about and embrace the role of non-cognitive skills within the classrooms of today, the greater the chances of increasing students' academic success.

Summary of Results

This quantitative study utilized a sample of 76 students who were at the end of their second grade year in a rural school district in northern Michigan. The subject group had an equal representation of males and females with little diversity (72% White, 22% Native American and 5% other). The socioeconomic status of the subjects, as measured by free and reduced lunch status, included 58% free or reduced status and 42% full pay status. In addition to the 76 student subjects, six second grade teachers were utilized as informants for the completion of the Grit-S scale on behalf of the subjects in their classrooms.

There were two main instruments utilized in this study. The first was the Grit-S scale that was created by Angela Duckworth. This 8-item Grit scale uses a 5-point Likert-type scale to

determine a subject's grit score. Scores range from 1 to 5 with 5 being *extremely gritty* and 1 being *not at all gritty*. After multiple studies, this scale has consistently demonstrated reliability and validity. Cronbach's coefficient alpha (Crocker & Algina, 1986) has been used to evaluate the internal consistency of the 8-item Grit Scale with a score of 0.64. One of the studies conducted, utilized informants to complete the grit scale on behalf of another person. This application of the Grit-S also demonstrated validity. The correlations between the self-reported version and informant version were $r = .45$, $p < .001$ and $r = .47$, $p < .001$, which are considered medium to large (Duckworth & Quinn 2008).

The second instrument utilized for this study was the NWEA MAP Growth assessment, which is administered to students in Grades K-10 three times per school year to measure academic growth and achievement in the areas of mathematics, reading, and science. These assessments provide a wealth of student performance information in the form of numerous computer-generated reports that provide information on particular individual skills sets and grade level standards as well as a composite score in each content area assessed. For the purpose of this study, only the composite scores in the content areas of mathematics and reading were considered.

Academic achievement and growth were measured by the comparison of the subjects' MAP scores in the areas of mathematics and reading. Data points were collected for mathematics and reading when the subjects entered kindergarten in September 2015 and when they completed second grade in May 2018. A series of Pearson product- moment correlation Coefficient (Pearson r) analysis was utilized to analyze the data to depict the relationship between student achievement and grit. An analysis of the data also included considering the relationship between kindergarten entry scores and scores at the completion of second grade. To deepen the value of

the study, additional variables were included such as race, gender, age at kindergarten entrance, school attendance and socioeconomic status.

The subjects were divided into two categories for the variable groups of gender, race, attended junior kindergarten, and socioeconomic status. The categories were used to determine relationships between the variables. The data were analyzed using the full field of subjects using one tailed correlational analysis.

In this researcher's opinion, the results created more questions than answers. A close look at the relationship between the subjects' kindergarten scores and second grade scores demonstrates a moderate to strong chance that if students perform well on the kindergarten assessment, they will also perform well on the end of second grade assessments. Another interesting finding was a strong statistically significant relationship between the second grade mathematics performance and reading performance $r = .693$, $p < .000$. When grit was factored into the analysis, there was a strong significant relationship between the subjects grit and second grade achievement scores in mathematics $r = .506$, $p < .000$ and reading $r = .549$, $p < .000$. This would lead this researcher to believe that if an educator would actively cultivate grit in students, an increase in reading and mathematics achievement will also be achieved. Strong significant relationships were established between grit and second grade MAP achievement scores and between second grade reading and mathematics scores. Relationships with varying degrees of significance were noted when the difference between second grade scores and kindergarten scores were compared with the other variables.

A strong relationship that was highly significant was found between grit and socioeconomic status $r = .446$, $p < .000$ and grit and school attendance $r = .403$, $p < .000$. Some

relationships with varying degrees of significance were established between the other variables considered when compared to grit or when compared to each other.

In conclusion, grit as a predictor of academic achievement in the content areas of mathematics or reading was not solidly proven; however, this study does demonstrate grit does play a role in student achievement. There is enough evidence to support more attention to the development of non-cognitive skills, specifically grit, within the classrooms of today, beginning with our youngest elementary school learners.

Implications

This research explored the relationship between academic achievement and grit in a sample group of 76 second grade students. Kindergarten and second grade composite MAP scores in the areas of reading and mathematics measured achievement. Grit was measured using the Grit-S Scale developed by Angela Duckworth (2012). The review of the literature showed current research supports the need to look beyond cognitive skills as measures of academic performance and delve into non cognitive skills (resilience, conscientiousness, optimism, self-control, goal commitment, perseverance, and grit) as measures of academic performance and possible predictors of future success (Tough, 2016; Pritchard & Wilson, 2003).

Studies of non-academic skills as measures of academic achievement are not new to the field of education. Psychologists have established these non-cognitive skills as reliable, valid, measurable, and strongly predictive of future outcomes decades ago (Bandura, 1977). This belief has resurfaced with the December 2015 Every Student Succeeds Act (ESSA). ESSA has sparked a newfound interest in the utilization of non-cognitive skills as measures of student success. ESSA requires states to include at least one non-academic measure in their accountability

systems. ESSA also includes the provision of federal funding for the purpose of exploring, field-testing, and utilizing non-cognitive measures of student success or achievement.

School districts can consider the essential elements of the theoretical frame for this study a recipe to grow successful learners. The theoretical framework for this study is grounded in Alfred Bandura's (1977) social cognitive theory. Bandura posits that learners are only able to learn if they are motivated to stay on task (self-regulation and self-efficacy) to gain an understanding of what is to be learned. Self-efficacy is an especially critical influence on motivation and affects learning choices, effort, and persistence, which all lead to achievement. Furthering the theoretical frame is Angela Duckworth's grit theory as a predictor of academic success. Once a student is motivated to learn, Duckworth's concept of grit determines if learners are motivated to set a goal for their learning and persevere until the goal attainment. The final piece to this theoretical frame is the Theory of Mindset (TM) (Dweck 2006), the belief that in order for the most learning to occur, one must have a growth mindset, a belief that continual learning can take place over the span of life.

Applying this theoretical frame to the measurement of academic success urges one to explore the notion that academic success is measurable by more than cognitive skills. The importance of non-cognitive skills as measures of academic success is of equal importance. Combining the theories of Bandura, Duckworth, and Dweck, one can surmise that a student may demonstrate cognitive skills as they enter the world of academia, but if instruction is not in their zone of proximal development, they do not believe they can learn and they do not have grit; thus, their academic success will be limited. Applying this theoretical frame, if a student starts school with limited cognitive skills but is motivated to learn, has grit, believes he/she can learn, and is

provided instruction in their ZPD, the likeliness of academic growth and success is elevated exponentially.

This study contributes to the field of education as means for district to establish policy and guidelines for districts to embrace and implement. Establishing policy about incorporating non-cognitive skills into the classrooms of today can be used to springboard districts into fulfilling the rigor of ESSA.

When curriculum material is introduced to a school district, one of the determining factors of whether or not the district adopts the proposed curriculum is cost. This study offers support of the potential benefits acquired when non-cognitive skills are explicitly taught in the classroom. Unlike many other curriculum ideas, the cost of implementing the teaching of non-cognitive skills in the classroom is minimal. There are established curriculums that can be purchased, but they are not required to effectively practice the explicit teaching and development non-cognitive skill.

The only real cost to a school district would be that of educating and training staff about the role non-cognitive skills play in student achievement. Non-cognitive skills can be taught and fostered by how a teacher approaches student successes and student failures in the classroom. Teaching practices that foster non-cognitive skills in students begins with the teacher having a growth mindset and believing they can impart a growth mind set in their students. Carol Dweck (2008) posits, "Mindsets are an important part of your personality, but you can change them just by knowing about the two types of mindsets and how to think and react" (p. 46).

The development of a growth mindset and the development of grit utilize many of the same practices. Making students aware of TM and grit is the foundation of growing these constructs within the students. Ricci (2013) advocates for starting the teachings of grit and TM at a young

age. Students introduced to TM and grit theory will be better equipped to cope with challenges that may arise as they move through school. Students who have a growth mindset and grit will know what to do if they fail or begin to struggle with a task. Students without a growth mindset or grit are more likely to quit when faced with failure or a challenge for fear of failing again (Duckworth, 2016).

In a blog, Elmore (2014) provided a list of classroom practices to foster perseverance and grit in students based on the findings from a study of students in Singapore. Teachers should talk about the power of mindset and grit as related to success. Stories of people who have these traits should be shared with the students along with demonstrating the positive impact of grit. It is important to share the "why" the students are being asked to participate in a given task as tasks must have meaning or relevance to a student for learning to occur. Students may give up if they feel alone or not part of a group. Students need opportunities to work in a group to solve problems together or fail together. Failure is an opportunity to learn, students need to be given opportunities to make mistakes or fail. Students need to practice grit and be able to recognize grit when they see it in themselves and others. Teachers should focus on achievements that are the result of hard work rather than celebrating all achievements. Celebrations of achievement should always focus on effort expended that resulted in the task completion.

The time is ripe for schools to embrace the value of non-cognitive skills in the search for improving student achievement. Districts would benefit from educating teachers about the role and development of non-cognitive skills within the world of academia. Once an understanding is established, providing the teachers with professional development and opportunities to teach and cultivate non-cognitive skills within their educational environments would enable them to grow high achieving lifelong learners.

Limitations

First, generalizability must be considered as a limitation. This study was conducted with 76 second grade students in a rural school district in northern Michigan. The second grade population of 121 students was reduced to 76 subject when the following study participation factors were applied: student was continuously enrolled in SAPS from kindergarten through second grade, they took the MAP Growth assessment at kindergarten entry, and at the conclusion of second grade and parental consent to participate obtained. The second limitation would be the use of informants for the completion of the Grit-S on behalf of each subject. Although the use of informants for the Grit-S was been found to be valid in this case, teacher bias cannot be ruled out. The last limiting factor would be the reliability of the individual subject's MAP scores. The MAP assessments are administered to each classroom group of students in a computer lab with one teacher as the proctor. It is an assumption that the subjects completed each administration of the assessment with fidelity.

Recommendations for Future Study

This research determined there is more to be known about the role of grit as a predictor of academic success. The growing interest in grit and understanding the development and impact grit has on young learners needs further examination. Following the subjects of this study longitudinally as they progress through their academic career, would provide a better understanding of the construct.

A recommendation would be to replicate this study in other schools and grade levels. It is of interest if results would be consistent with older students and in more and less populated areas. This would improve the generalization aspect of this study.

This study could be continued by exploring a qualitative component. Interviews with classroom teachers, parents, and the students about their perceptions of the role of non-cognitive skills, specifically, grit in the classroom would provide addition insight the construct.

A replication of this study using a different cognitive measure with the same subjects and then again, with a different subject group would lead to the generalizability of the study. The Grit-S would remain the constant and the variable of student achievement would be fluid.

Finally, the continuation of researching how to teach and grow grit and other non-cognitive skills would be beneficial to field of education. Providing educators information and classroom applications about the role of non-cognitive skills in the classroom would afford them the opportunity to establish classroom behavior and learning expectations that promote the environment that supports the growth of non-cognitive skills in their classrooms; therefore enhancing student success.

Conclusion

This research considered the theoretical constructs of social cognitive theory, goal setting theory, self-efficacy, theory of mindset, and grit. The theoretical frame was applied to investigate the literature about the development of grit and the relationship between grit and predicting student achievement. Putting the literature into practice, the classrooms of today need to foster growth mindsets as a way of life in the classroom. This includes praising student efforts, not successes, and helping students learn from failures. Students need opportunities to be an active participant in their learning by setting their own learning goals that are in their ZPD and then afforded guidance and time to work towards goal attainment. If all of the above factors are in place, students will be able to demonstrate self-efficacy, develop intrinsic motivation, heighten

their growth mindset, and become grittier, which in turn, will increase student achievement scores.

The findings demonstrated a relationship between grit and student achievement. While a relationship was minimal to moderate between grit and student growth from kindergarten to second grade, a relationship was clearly established between grit and second grade student achievement.

There is still much exploration needed on grit as a predictor of student achievement and the role of grit in student achievement. Grit has been proven to influence successes across a vast group of subjects encompassing a wide array of students, professionals, and laborers (Duckworth, 2016). Through the exploration of the constructs of the theoretical frame, the importance motivation and goal setting theory play in student development and achievement came to the forefront.

This research has explored the constructs of the theoretical frame as each relates to student achievement in the cognitive and non-cognitive domains. This research project has deepened the understanding of the role of non-cognitive skills in student achievement. It provides an avenue for districts to develop school policy about the importance and need to activity teach to non-cognitive skills within the classrooms of today if districts are going to meet the expectations and requirements of ESSA.

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Appendices

Appendix A: MAP Student Progress Report

map GROWTH

Student Progress Report

Student, Sample
Student ID: 1234567890

Term Rostered: Spring 2010-2011
District: Sample School District
School: Sample School
Growth Comparison Period: Spring to Spring

[7]

Quick Reference

This report displays current and past RIT scores of a student. RIT stands for Rasch Unit, which is a unit of measure that uses individual test question difficulty values to estimate student achievement.

The RIT is used to measure how "tall" a student is on the curriculum scale and scores can be compared to tell how much growth a student has made, similar to measuring height on a yardstick. This score is independent of the age or grade of the student but reflects the instructional level at which the student is currently performing, helping teachers plan instruction at an appropriate level for the student.

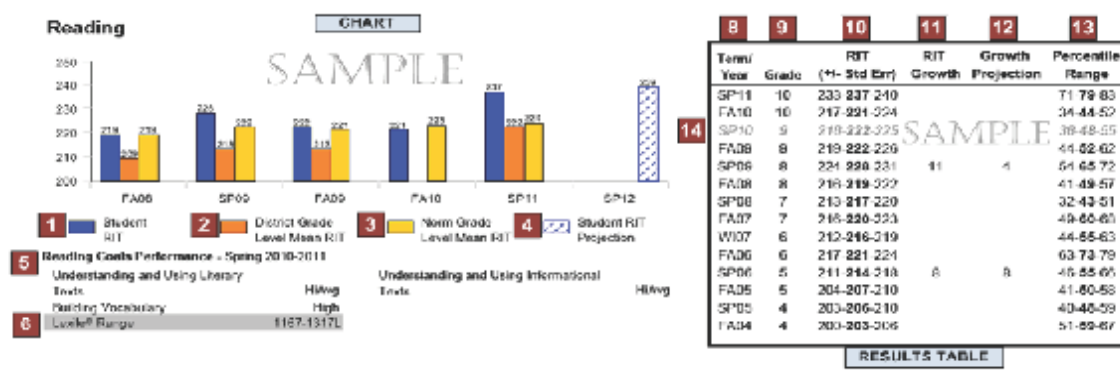If you have questions about this report, please contact your child's school.

Reading — CHART

[chart: Student RIT, District Grade Level Mean RIT, Norm Grade Level Mean RIT, Student RIT Projection — terms FA08, SP09, FA09, FA10, SP11, SP12]

[1] Student RIT [2] District Grade Level Mean RIT [3] Norm Grade Level Mean RIT [4] Student RIT Projection

[5] Reading Goals Performance - Spring 2010-2011

Understanding and Using Literary Texts		Understanding and Using Informational Texts	
	HiAvg		HiAvg
Building Vocabulary	High		

[6] Lexile® Range — 1167-1317L

RESULTS TABLE

	[8]	[9]	[10]	[11]	[12]	[13]
	Term/Year	Grade	RIT (+/- Std Err)	RIT Growth	Growth Projection	Percentile Range
	SP11	10	233-237-240			71-79-83
	FA10	10	217-221-224			34-44-52
[14]	SP10	9	219-222-225			38-48-55
	FA09	8	219-222-226			44-52-62
	SP09	8	224-228-231	11	4	54-65-72
	FA08	8	216-219-222			41-49-57
	SP08	7	213-217-220			32-43-51
	FA07	7	216-220-223			49-60-65
	WI07	6	212-216-219			44-55-63
	FA06	6	217-221-224			63-73-79
	SP06	5	211-214-218	8	8	46-55-65
	FA05	5	204-207-210			41-50-58
	SP05	4	203-206-210			40-48-59
	FA04	4	200-203-206			51-60-67

Chart Legend

1 Student RIT – The student's RIT score on each growth test.

2 District Grade Level Mean RIT – The average RIT score for students in the same school district and same grade that were tested at the same time as the student named on this report. Lack of the District Grade Level Mean RIT bar indicates that the RIT is not available due to the district testing window not being closed.

3 Norm Grade Level Mean RIT – The average RIT score for students in the same grade and tested in the same term as observed in the most recent NWEA RIT Scale Norms study. Lack of the Norm Grade Level Mean RIT bar indicates that the RIT is not available due to no norm data being available for that particular grade and/or subject.

4 Student RIT Projection – The projected RIT score of the student for when they take a future test. This projected RIT score is based on the student's actual RIT score in the first term of the Growth Comparison Period and the average RIT growth of students who were in the same grade and tested in the same term as observed in the most recent NWEA RIT Scale Norms* study.

5 Goals Performance – Each goal area included in the test is listed along with a goal range or descriptive adjective of the student's score. The possible descriptors are Low (percentile < 21), LoAvg (percentile between 21 and 40), Avg (percentile between 41 and 60), HiAvg (percentile between 61 and 80), and High (percentile > 80). An asterisk (*) is displayed if the goal score was not able to be calculated due to too many items answered incorrectly or too few items available in the RIT range assessed.

6 Lexile® Range – This range appears when the student has taken a reading test. You can use it with online resources to identify appropriately challenging books, periodicals, and other reading material for the student. Lexile® is a trademark of MetaMetrics, Inc., and is registered in the United States and abroad.

Results Table Legend

7 Growth Comparison Period – The terms that define the time frame for which the RIT Growth, Growth Projection and Student RIT Projection value(s) are calculated.

8 Term/Year – The test term (FA=fall, SP=spring, WI=winter, SU=summer) and the year when the student took the test.

9 Grade – Grade of the student when the test was taken.

10 RIT – The middle number is this student's RIT score. The numbers on either side of the RIT score define the score +/- the standard error. If retested soon, the student's score would fall within this range most of the time.

11 RIT Growth – Presents the student's growth in RIT points made between growth tests in the Growth Comparison Period.

12 Growth Projection – The average growth of students who were in the same grade and began the same term at a similar RIT score according to the most recent NWEA RIT Scale Norms* study.

13 Percentile Range – The number in the middle is this student's percentile rank, or the percentage of students that had a RIT score less than or equal to this student's score according to the most recent NWEA RIT Scale Norms study. The numbers on either side of the percentile rank define the percentile range. If retested soon, this student's percentile rank would be within this range most of the time.

14 Non-growth tests – Tests may be taken from time to time for informational purposes only and are not used to determine student growth. These tests are presented in gray italicized text.

nwea

Appendix B: Grit-S

Grit-S

Directions for taking the Grit Scale: Please respond to the following 8 items. Be honest – there are no right or wrong answers!

1. New ideas and projects sometimes distract me from previous ones.

   ❑ Very much like me
   ❑ Mostly like me
   ❑ Somewhat like me
   ❑ Not much like me
   ❑ Not like me at all

2. Setbacks don't discourage me.

   ❑ Very much like me
   ❑ Mostly like me
   ❑ Somewhat like me
   ❑ Not much like me
   ❑ Not like me at all

3. I have been obsessed with a certain idea or project for a short time but later lost interest.

   ❑ Very much like me
   ❑ Mostly like me
   ❑ Somewhat like me
   ❑ Not much like me
   ❑ Not like me at all

4. I am a hard worker.

       ❑Very much like me
       ❑Mostly like me
       ❑Somewhat like me
       ❑Not much like me
       ❑Not like me at all

5. I often set a goal but later choose to pursue a different one.
       ❑Very much like me
       ❑Mostly like me
       ❑Somewhat like me
       ❑Not much like me
       ❑Not like me at all

6. I have difficulty maintaining my focus on projects that take more than a few months to complete.

       ❑Very much like me
       ❑Mostly like me
       ❑Somewhat like me
       ❑Not much like me
       ❑Not like me at all

7. I finish whatever I begin.

       ❑Very much like me
       ❑Mostly like me
       ❑Somewhat like me
       ❑Not much like me
       ❑Not like me at all

8. I am diligent.
- ❏Very much like me
- ❏Mostly like me
- ❏Somewhat like me
- ❏Not much like me
- ❏Not like me at all

Scoring:
1. For questions 2, 4, 7 and 8 assign the following points:

5 = Very much like me 4 = Mostly like me 3 = Somewhat like me 2 = Not much like me

1 = Not like me at all

2. For questions 1, 3, 5 and 6 assign the following points:

1 = Very much like me 2 = Mostly like me 3 = Somewhat like me 4 = Not much like me

5 = Not like me at all

Add up all the points and divide by 8. The maximum score on this scale is 5 (extremely

gritty), and the lowest score on this scale is 1 (not at all gritty). (Duckworth et. al., 2007)

Appendix C: Modified Grit-S

Grit-S Modified

Directions for taking the Grit Scale: Please respond to the following 8 items. Be honest – there are no right or wrong answers!

1. New ideas and projects sometimes distract (student name) from previous ones.

❑Very much like (student name)

❑ Mostly like (student name)

❑Somewhat like (student name)

❑Not much like (student name)

❑Not like a (student name) all

2. Setbacks don't discourage student.

❑Very much like (student name)

❑Mostly like (student name)

❑Somewhat like (student name)

❑Not much like (student name)

❑Not like(student name) at all

3. (Student name) has been obsessed with a certain idea or project for a short time but later lost interest.

❑ Very much like (student name)

❑Mostly like (student name)

❑Somewhat like (student name)

❑Not much like (student name)

❑Not like (student name) at all

4. (Student name) is a hard worker.

❑Very much like (student name)
❑Mostly like (student name)
❑Somewhat like (student name)
❑Not much like (student name)
❑Not like (student name) at all

5. (Student name) often sets a goal but later choose to pursue a different one.

❑Very much like (student name)
❑Mostly like (student name)
❑Somewhat like (student name)
❑Not much like (student name)
❑Not like (student name) at all

6. (Student name) has difficulty maintaining focus on projects that take more than a few months to complete.

❑Very much like (student name)
❑Mostly like (student name)
❑Somewhat like (student name)
❑Not much like (student name)
❑Not like (student name) at all

7. (Student name) finishes whatever he/she begins.

❑Very much like (student name)
❑Mostly like (student name)
❑Somewhat like (student name)
❑Not much like (student name)
❑Not like (student name) at all

8. (Student name) is diligent.

❑Very much like (student name)
❑Mostly like (student name)
❑Somewhat like (student name)
❑Not much like (student name)
❑Not like (student name) at all

Scoring:

1. For questions 2, 4, 7 and 8 assign the following points:

5 = Very much like student 4 = Mostly like student 3 = Somewhat like student 2 = Not much like

student 1 = Not like student at all

2. For questions 1, 3, 5 and 6 assign the following points:

1 = Very much like student 2 = Mostly like student 3 = Somewhat like student 4 = Not much like

student 5 = Not like student at all

Add up all the points and divide by 8. The maximum score on this scale is 5 (extremely

gritty), and the lowest score on this scale is 1 (not at all gritty). Revised from Grit-S (Duckworth

et. al., 2007)

Appendix D: IRB Approval Letter

May 29, 2018 9:42 PM EDT

Sheri McFarlane
Eastern Michigan University, Leadership and Counsel

Re: Expedited Review - Initial - UHSRC-FY17-18-374 Assessing the Relationship of Grit and Student Achievement in Reading and Math in 2nd Grade Students of the Sault Ste. Marie Public School District

Dear Sheri McFarlane:

The Eastern Michigan University Human Subjects Review Committee has rendered the decision below for Assessing the Relationship of Grit and Student Achievement in Reading and Math in 2nd Grade Students of the Sault Ste. Marie Public School District. You are approved to conduct your research.

Decision: Approved

Selected Category:

Findings: You must use stamped copies of your recruitment and consent forms.

To access your stamped documents, follow these steps: 1. Open up the Dashboard; 2. Scroll down to the Approved Studies box; 3. Click on your study ID link; 4. Click on "Attachments" in the bottom box next to "Key Contacts"; 5. Click on the three dots next to the attachment filename; 6. Select Download.

Renewals: This approval is valid for one year and expires on May 28, 2019. If you plan to continue your study beyond May 28, 2019, you must submit a continuing review application in Cayuse IRB at least 14 days prior to May 28, 2019 so that your approval does not lapse.

Modifications: All changes to this study must be approved prior to implementation. If you plan to make any changes, submit a modification request application in Cayuse IRB for review and approval. You may not implement your changes until you receive a modification approval letter.

Problems: All deviations from the approved protocol, unanticipated problems, adverse events, subject complaints, or other problems that may affect risk to human subjects or alter their willingness to participate must be reported to the UHSRC. Complete the incident report application in Cayuse IRB.

 Please contact human.subjects@emich.edu with any questions or concerns.

Sincerely,

Eastern Michigan University Human Subjects Review Committee

Appendix E: Invitation to Participate

Invitation to Participate

Dear Parent:

I am the current principal of Lincoln Elementary School and the director of special education for the Sault Area Public Schools. I am pursuing a doctoral degree from Eastern Michigan University. Part of the requirements of my course of study is to conduct a research project.

Your child is being invited to participate because they meet the following criteria: he/she is currently enrolled in second grade in Sault Ste. Marie Area Schools and he/she has been continuously enrolled in the district since the 2015-2016 school year.

I will have no direct contact with your child as part of the research project. My research project will require the use of student data within our student information system. Although, as a district administrator, I have assigned access to all data needed for this research, I am required to obtain your signed consent to use the data for research purposes. The consent form is attached.

I would greatly appreciate it if you would please review and sign the attached consent form. The signed consent can be returned to your child's school in the envelope provided. I am looking forward to being able to include as many second grade students possible.

Participation in research is voluntary. Please feel free to ask any questions you have about your child's participation in this study. My email is smfarlane@eupschools.org or phone is 906 635-6639.

Thank you,

Sheri L. McFarlane, Ed.S
Principal, Lincoln Elementary School
Director of Special Education

Approved by the Eastern Michigan University Human Subjects Review Committee
UHSRC Protocol Number: UHSRC-FY17-18-374
Study Approval Dates: 5/29/18 – 5/28/19

Parental Consent Form

Project Title: Relationship Between Grit Score and Student Achievement
Principal Investigator: Sheri McFarlane, Eastern Michigan University
Faculty Advisor: Dr. James Berry, Eastern Michigan University

Invitation for your child's demographic information and NWEA MAP scores to be used for research

As a second grade student in the Sault Area Public School system, your child is invited to participate in a research study that is being conducted by Mrs. McFarlane, Lincoln principal and director of special education. Your child is invited to participate because they meet the following criteria: he/she is currently enrolled in 2nd grade in Sault Ste. Marie Area Schools and has been continuously enrolled in the district since the 2015-2016 school year. Participation in research is voluntary. Please feel free to ask any questions you have about participation in this study. All contact information is included in the final page of this document.

Important information about this study

- The purpose of the study is to explore the relationship between a student's grit and his/her academic growth on the NWEA MAP between entry to kindergarten and ending 2nd grade.
- Participation in this study involves
  - Having your child's teacher completing an 8 questions Grit S rating scale for your child. The survey is in a Likert scale format. No written or narrative responses will be collected.
  - allowing Mrs. McFarlane to access your child's NWEA MAP scores for research purposes
  - There will be no direct contact with your child for this research
- There are no potential risks to your child by participating in this study
- The investigator will protect your child's confidentiality by removing all student names and randomly assigning student numbers. There will be no identifying information that would include which school or classrooms the student attended
- Participation in this research is voluntary. Your child does not have to participate, and if you and your child decide to participate, you or your child can stop at any time.

What is this study about?

- The purpose of the study is to see if there is a relationship between a student's Grit Score and their academic growth on the NWEA MAP between entry to kindergarten and ending 2nd grade.

What will happen if my child participates in this study?

Participation in this study involves no direct contact with your child. All information collected will be done through the student information systems we have in place in Sault Area Schools other than the Grit S survey, which will be completed by your child's teacher.

What types of data will be collected?

NWEA MAP scores
Gender
Socioeconomic status
Race
Age

What are the anticipated risks for participation?

There are no anticipated physical or psychological risks to participation.

Are there any benefits to participating?

You and your child will not directly benefit from participating in this research.

Benefits to the field of education include information about the impact of students' Grit score on their achievement. This would allow teachers to learn more about how increase students' grit.

How will my child's information be kept confidential?

I plan to publish the results of this study. We will not publish any information that can identify your child. All students will be provided a random student number for the purposes of this study. No teacher names will be used, as there will be no reference made to school building or teacher within this study.

I will keep your child's information confidential by using an assigned student number for each student. Once the code is established, all student names will be removed. The original Grit S surveys, with the student names, will only be seen by me. Once the student number is established, the surveys will be stored in my locked desk in which, I am the only one with a key.

All computer generated records and spreadsheets will be password protected by two separate log in screens.

I will store your child's information for at least three years after this project ends, but I may store

your child's information indefinitely. If I still have your child's identifiable information when your child turns 18, I will contact your child to obtain their consent to retain their information going forward.

I will make every effort to keep your child's information confidential, however, we cannot guarantee confidentiality. Other groups may have access to your child's research information for quality control or safety purposes. These groups include the University Human Subjects Review Committee, the Office of Research Development, the sponsor of the research, or federal and state agencies that oversee the review of research, including the Office for Human Research Protections and the Food and Drug Administration. The University Human Subjects Review Committee reviews research for the safety and protection of people who participate in research studies.

If, during your child's participation in this study, we have reason to believe that elder abuse or child abuse is occurring, or if we have reason to believe that your child is at risk for being suicidal or otherwise harming himself or herself or anyone else, we must report this to authorities as required by law. We will make every effort to keep your child's research information confidential. However, it may be possible that we have to release your child's research information. If this were to occur, we would not be able to protect your child's confidentiality.

Storing study information for future use

I WILL NOT store your child's information to study in the future.

We may share your child's information with other researchers without asking for your permission, but the shared information will never contain information that could identify you or your child. We will send your de-identified information by email and only upon request.

What are the alternatives to participation?

The alternative is not to participate.

Are there any costs to participation?

Participation will not cost you or your child anything.

Will my child be paid for participation?

Your child will not be paid to participate in this research study.

Study contact information

If you or your child has any questions about the research, you can contact the Principal
Investigator Sheri McFarlane
Doctoral candidate researcher
Eastern Michigan University
smcfarlane@eupschools.org 906-203-5219

Or

Dr. James Berry
Faculty Advisor
Department of Leadership and Counseling
Eastern Michigan University College of Education
jberry@emich.edu   734-487-0255

If you have any concerns about your treatment as a participant in this study, please call or write:

Chair, University Human Subjects Review Committee
Eastern Michigan University
202E Boone Hall
Ypsilanti, MI 48107
734-487-3090

For questions about your child's rights as a research subject, contact the Eastern Michigan
University Human Subjects Review Committee at human.subjects@emich.edu or by phone at
734-487-3090.

Voluntary participation
Participation in this research study is your and your child's choice. Your child either will be
asked independently for assent or his or her dissent will be respected. You and your child may
refuse to participate at any time, even after signing this form, with no penalty or loss of benefits
to which you and your child are otherwise entitled. You and your child may choose to leave the
study at any time with no loss of benefits to which you and your child are otherwise entitled. If
you and your child leave the study, the information your child provided will be kept confidential.
You and your child may request, in writing, that your child's identifiable information be
destroyed. However, we cannot destroy any information that has already been published.

Statement of Consent
I have read this form. I give my consent to for my child to participate in this research study.

Signatures

_____
 Name of Child

_____
 Name of Parent

_____   _____
Signature of Parent   Date

I have explained the research to the parent and answered all his/her questions. I will give a copy of the signed consent form to the parent.

_____
Name of Person Obtaining Consent

_____   _____
Signature of Person Obtaining Consent   Date

Appendix F: Informed Consent Statement

Informed Consent:

Thank you for participating in this research project. Please complete the following Grit-S surveys as honestly as possible. These questions concern student perseverance (grit).

The purpose of this survey is to help the researcher measure the students' grit as it relates their academic growth.

I do not anticipate that taking this survey will contain any risk or inconvenience to you. Although greatly appreciated, your participation is strictly voluntary. You may withdraw your participation at any time. Completion of the student surveys should take less than an hour.

All information collected will be used only for my research and will be kept confidential. There will be no connection to you specifically or to your school in the results or in future publication of the results.

Once the study is completed, I would happy to share the results with you upon your request. If you have any questions please do not hesitate to contact:

Sheri McFarlane
Doctoral candidate researcher
Eastern Michigan University
smcfarlane@eupschools.org 906-203-5219

Or

Dr. James Berry
Faculty Advisor
Department of Leadership and Counseling
Eastern Michigan University College of Education
jberry@emich.edu   734-487-0255

If you have any concerns about your treatment as a participant in this study, please call or write:

Chair, University Human Subjects Review Committee
Eastern Michigan University
202E Boone Hall
Ypsilanti, MI 48107
734-487-3090

Appendix G: Teacher Directions for Completing the Grit Scale Survey

Teacher directions to completing the Grit Scale Survey

Dear _____

Thank you for agreeing to participate in this investigation. You are being asked to only complete the surveys you have been provided. Each survey has been pre populated with the student's name and identification number for the purposes of this investigation. Once the students grit score is recorded, the names will all be removed and only numbers will remain; therefore, there will be no identifying information shared regarding the student or the person completing the survey.

Please answer each of the 8 questions on each student survey. Please provide honest answers as you rate your perception of the student on the 5-point scale for each of the 8 questions. Please do not change the questions or answers in any form. Each of the surveys should take less than 5minutes to complete.

When you have completed all of the surveys provided to you, please put them in the envelope provided and leave them in the _____ office on May_____ and I will come and pick them up.

I greatly appreciate your time and assistance with completing the surveys.

Thank you,

Sheri

Appendix H: MAP Student Goal Setting Worksheet

Student Goal Setting Worksheet

map GROWTH

Diamond, Kiley A.
Student ID: SF06000779
District: NWEA Sample District 3
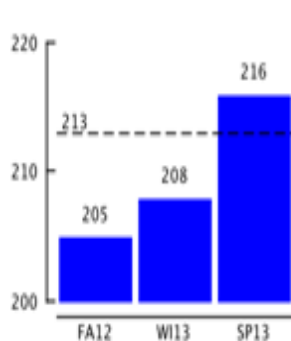School: Three Sisters Elementary School
Term Rostered: Fall 2013-2014

Norms Reference Data:	2015
Growth Comparison Period:	Fall 2012 to Spring 2013
Weeks of Instruction:	Start – 4 (Fall 2012)
	End = 32 (Spring 2013)

Mathematics (MAP: Math 2-5 Common Core 2010)

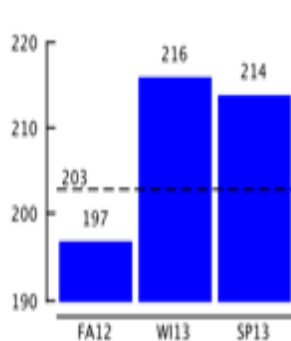|	FA12	WI13	SP13
Overall RIT Score	205	208	216
Goal Performance			
Geometry		208-217	214-224
Measurement and Data		199-208	206-214
Operations and Algebraic Thinking		208-219	219-230
Number & Operations		196-207	208-218

Student Action Plan:

Projected RIT 213
My Goal _____
RIT Growth 11

Reading (MAP: Reading 2-5 Common Core 2010)

	FA12	WI13	SP13
Overall RIT Score	197	216	214
Goal Performance			
Literature		205-213	219-228
Informational Text		211-220	205-216
Foundational Skills and Vocabulary		219-229	210-219
Lexile® Range	447-597L	789-939L	753-903L

Student Action Plan:

Projected RIT 203
My Goal _____
RIT Growth 17

Student Signature: _____   Instructor Signature: _____

Parent Signature: _____   Date: _____

Explanatory Notes

RIT ranges may indicate an `area of relative strength` or `area of possible concern` determined by comparing the student's Goal Performance score with the student's Overall RIT Score for the test event.

* Projected RIT is only reported when there is growth norm data and a test event in the initial term. RIT Growth is only reported when there are test events in both the initial and final terms. Lexile® is a trademark of MetaMetrics, Inc., and is registered in the United States and abroad.