THE RELATIONSHIP BETWEEN STUDENTS' TRACKING OF THEIR LEARNING DATA AND THEIR ACADEMIC ACHIEVEMENT IN FIFTH-GRADE MATHEMATICS

by

Angela Van Sant Poag

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

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ABSTRACT

Teachers are in a constant cycle of data collection to guide instruction and increase student achievement; however, students are not always involved in the data collection or discussion of their own learning data. The purpose of this correlational study was to explore the relationship between students' tracking of their own learning data and their academic achievement in fifth-grade mathematics as measured by the aimswebPlus assessment. A convenience sample of 154 students from a middle school in a southern Tennessee school district participated in the study using archival data. A Pearson Product Moment Correlation was used to test the null hypothesis to describe the strength and direction of the relationship between students' tracking of their own learning data as measured by a researcher-created instrument and their academic achievement as measured by the aimswebPlus assessment. It was discovered that no significant relationship was found between students' tracking of their own learning data and their academic achievement in fifth-grade mathematics. It was concluded that the relationship between students' fidelity to data tracking and their overall academic achievement could possibly have been significant if the teachers and students received more training on how to track data and use the data tracker notebooks and if students not only tracked their learning data but set individual learning goals based on the data. Since clearer training and the use of student-focused goals was considered as the next step in the process of using student data to increase their academic achievement and allow students to be leaders in their own learning, it would be helpful to conduct a study that seeks to determine the types of student data tracking tools and processes that are most beneficial to increasing student achievement.

Keywords: academic achievement, mathematics, middle school, data tracking

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List of Abbreviations

American Recovery and Reinvestment Act (ARRA)

Common Formative Assessments (CFA)

Education Commission of the States (ECS)

Elementary and Secondary Education Act (ESEA)

High Reliability Organizations (HRO)

Institutional Review Board (IRB)

Math Concepts and Analysis (CA)

Mental Computation Fluency (MCF)

No Child Left Behind Act (NCLB)

Number Sense Fluency (NSF)

Personalized Learning Platform (PLP)

Professional Learning Community (PLC)

Project Based Learning (PBL)

Strategic Measurable Attainable Relevant Timely (S.M.A.R.T. Goal)

Rate of Improvement (ROI)

Universal Design for Learning (UDL)

CHAPTER ONE: INTRODUCTION

Overview

The educational landscape is driven by high-stakes assessments, and teachers are in a constant cycle of administering assessments to students. Students are asked to show their learning and progress towards mastery through daily formative assessments, unit summative assessments, quarterly district benchmark assessments, and end-of-year state proficiency assessments. Kunnath (2017) stated, "Experts are in agreement that grades largely fail to accomplish their main purpose in communicating student academic achievement" (p. 68). As the cycle continues and teachers administer assessments, data are collected on student progress. These data are used to guide teachers in planning and instruction; however, students are not always privy to their own learning data, active in the data collection process, or using data to guide their learning and progress towards academic achievement.

Wesson and Derrer-Rendell (2011) stated, "A lack of confidence in one's ability to succeed on a task will lead to low expectations for the outcome of the task, whereas one will have higher expectations for the outcome of tasks felt to be achievable" (p. 5). Research has also focused on the more general construct of students' confidence as related to their academic self-concept. According to Sander and Sanders (2009), academic confidence is the confidence of a student regarding how they will respond to the demands of higher-level studying. Students' academic confidence has been found to be an important factor in how they approach studies, learning, and content. McMillan (2003) found that external demands, district level mandates, and high stakes assessment often conflict with teachers' values and beliefs. These demands are beyond teacher and student control but often impede students from truly being motivated to learn and succeed. Even with all the external and high stakes demands, it has been noted that teachers

still make grading and assessment decisions that will enhance student learning, student engagement, and motivation to learn in the classroom.

Background

Teachers are in a constant state of assessing students and collecting data on their progress. As stated by Dufour, DuFour, Akers, and Many (2010), "A high-quality public-school system is essential, not only for parents who send their children to these schools but also for the public good as a whole" (p. 4). This never-ending cycle of assessing and data collection is to ensure that students and schools remain on track for success. In education, failure is not an option, but it seems that teachers are spending more time administering assessments and collecting data rather than providing high-quality instruction. Educational leaders and teachers must be cognizant of maintaining a balance between assessments and the data collection utilized to drive instructional decisions without hindering instructional practices.

Historical Context

All learning begins with the schema, or the background knowledge and skills, which learners bring into the classroom environment. From as early as preschool, all learning is assessed. Some students simply are not motivated to learn regardless of their schema, achievement, mastery levels, or any intrinsic or extrinsic motivators. Student motivation is closely linked to learning and achievement. Motivation is defined as "the process of instigating and sustaining goal-directed behavior" (Schunk, 2016, p. 341). Motivation is key when engaging students in activities that facilitate learning. Current educational policies and procedures such as completing a unit of study, taking a test, assigning a grade, and moving on to the next unit of study do not increase student mastery and learning.

Standardized testing data have been used to assess student learning, hold schools accountable, and allocate educational opportunities since their earliest administration in the mid-19th century. Alcocer (2019) noted that as early as 1838 educators began articulating ideas that would become the formal assessments of student achievement. After World War I, standardized testing became standard practice in U.S. schools. By 1919, over 100 standardized tests were developed to measure student achievement in elementary and secondary schools (Alcocer, 2019). The use of achievement test data and IQ testing used to classify students was noted by the U.S. Bureau of Education in 1925. In 1936, the first automatic scanner was developed and has remained largely unchanged until the addition of writing sections to standardized tests in 2005 (Alcocer, 2019). Although standardized testing remains in U.S. schools, the Elementary and Secondary Education Act (ESEA) of 1965 opened the way for increased uses of norm referenced tests to evaluate educational programs (Alcocer, 2019). In 2001, another educational reform act, the No Child Left Behind Act (NCLB) brought the expansion of state mandated standardized testing as a means to evaluate and assess school academic performance in English, math, science, and social studies.

The ESEA of 1965 served as the basis for the NCLB Act of 2001. NCLB promoted excellence in education not only by ensuring that each child was taught by a highly qualified teacher but also by requiring teachers to make sure that all students met basic benchmark requirements (U.S. Department of Education, 2006). NCLB and the charge for school reform was led by President Obama and the initiation of the American Recovery and Reinvestment Act (ARRA) of 2009. ARRA provided an unprecedented $4.35 billion in Race to the Top grant funds to be awarded to states that were willing to aggressively address four primary areas of school reform: (a) to prepare students to be college and career ready after high school

graduation; (b) to recruit, retain and reward effective principals and teachers; (c) to build and utilize data systems that measure student achievement including formative measures for teachers and principals as they make instructional and organizational decisions; and (d) to turn around the lowest-achieving schools (U.S. Department of Education, 2009).

As standardized testing is one measure of student achievement, teachers use a variety of assessment tools such as quizzes, group projects, common formative assessments, and summative tests as part of the continuous process of grading and assessing student learning. The most intended purpose of any assessment tool is to ensure increased academic achievement of all students. Throughout the years, schools continue to implement standardized, formative, and summative assessments; however, the way districts, schools, and teachers use assessment data has changed. Schools have shifted to a greater focus on academic achievement and use of data to drive instruction and learning. School leaders work to guide teachers in data-focused conversations and data-driven problem solving and decision making to drive continuous improvements in student learning and academic achievement (Lipton & Wellman, 2012).

Social Context

To increase academic achievement, schools need to implement interdependent systems of operations and performance-based assessments of student learning such as the use of goal setting and collaborative learning and teaching. Before schools can implement these systems, there should be a focus on creating a high reliability school. According to Marzano, Warrick, and Simms (2014), the Marzano High Reliability Schools framework shows how best practices like professional learning communities (PLCs), teacher evaluation and development, vocabulary instruction, curriculum aligned to state standards, instruction in critical thinking and problem-solving skills, and assessments with standards-based grading work together to increase

effectiveness and student achievement. The framework provides five indicators to empower schools in measuring progress towards increasing levels of reliability and leading towards higher student achievement. The five indicators foundational for all schools are the following: (a) safe and collaborative culture, (b) effective teaching in every classroom, (c) a guaranteed and viable curriculum are foundational for all schools, (d) standards-referenced reporting of student progress, and (e) competency-based education are added to help drive positive, permanent, and significant impact on student achievement. The first three levels must be in place before the last two can be added. The levels are interdependent and must be worked on simultaneously to achieve success.

To create an environment within the high reliability school that leads to dramatic and widespread results in increased student academic achievement, school leaders must first align the school culture to the characteristics of a PLC (Warrick, 2018). Characteristics of a PLC are as follows: (a) common mission, value, vision, and goals, (b) collaborative culture, (c) collective inquiry, (d) action orientation, (e) continuous improvement, and (f) focus on results. DuFour et al. (2010) wrote six questions to guide educators as they work collaboratively in PLC:

1. What do we want students to know and be able to do?
2. How do we know they can do it?
3. What do we do when they can't do it?
4. What do we do when they can do it?
5. How will we increase our instructional competence?
6. How will we coordinate our efforts as a school?

Using effective PLCs and cycle of assessments can help ensure high-quality education for all students. PLCs allow schools to focus on student learning and achievement. According to DuFour et al. (2010),

> This commitment to high levels of learning for all students is the core mission of schools. But how does a school move beyond the pleasant platitudes of a generic mission statement to a culture in which learning is at the center of the day-to-day work of schooling? (p. 6)

Teacher collaboration within the PLC and the use of student learning data may allow schools to allocate time, resources, and human capital to what is truly important: student achievement. Through this cycle of assessments and data collection, teachers and students become data rich but not always data informed.

According to the Center on Education Policy (2012) whatever the goal, it is more likely to be motivating and increase student achievement if the goal is education-dependent, realistic and attainable, yet challenging, and differentiated to meet the needs of different students based on their mindsets and motivational styles.

> How the teacher introduces the goal-setting process, the degree of peer and teacher feedback of the goals, the consistent and regular review of goal setting during the course of the semester, the degree of participation of the student in the identification of the learning goals, the personalization of the learning goals, and the use of S.M.A.R.T. goals to evaluate the quality of student goals may play a significant role in the degree of student achievement. (Moeller, Theiler, & Wu, 2012, p. 96)

Most students recognize that learning is important but still are not motivated by academics or possess a desire to succeed. In a paper entitled *Can Goals Motivate Students?*, by

the Center on Education Policy (2012), the authors explored issues related to students' motivation to learn. The Center on Education Policy indicated "that if learning were reframed as a means to achieve a certain goal, these students would be better able to see its value" (p. 1). For some students having a certain end point or goal is enough motivation. The researchers also found that there are four dimensions of motivation: (a) competence, (b) control/autonomy, (c) value/interest, and (d) relatedness. These four dimensions of motivation are a crucial part of goal setting. The researchers stated, "To feel competent, students need to see their goals as realistic and achievable" (Center on Education Policy, 2012, p. 2). The second dimension of control/autonomy requires the students to set goals themselves or internalize goals for themselves if set by someone else and to see a clear path to achieving the goal. The last two dimensions involve more of the learning community. The researchers stated, "Student support for the goal will also foster interest and value" (Center on Education Policy, 2012, p. 2). Student support should come from the learning community, teachers, parents, and other stakeholders, and by knowing what they need to learn, what they have mastered, and how to grow in proficiency towards academic achievement.

Theoretical Context

This study is grounded in the theoretical frameworks of the self-determination and attribution theories. The first theory, self-determination theory, identified by Ryan and Deci (2000), focused on how quality of performance is affected by one's sense of well-being, initiative, and self-will. Social and cultural factors are those that support one's sense of competency and autonomy and increase cognitive engagement and motivation. According to self-determination theory, students who are cognitively engaged are more invested in their own learning and are more motivated. Ryan and Deci (2000) argued that if the social context was

unsupported or did not recognize an individual's needs, there was a negative impact.

Schunk (2016) defined the second theory, the attribution theory, as how people view the causes of their behavior and the behaviors of others. Attribution theory focuses on how rules are used, that people are inclined to seek information, and can influence one's motivational beliefs, emotions, and behaviors. The attribution learning theory has great importance in the field of education specifically when looking at the attribution theory's relevance to motivated learning for students.

Problem Statement

The empirical research is evident that teachers and students can positively impact student achievement through teacher participation in high-quality PLCs and the use of student goal setting (DuFour et al., 2010). The U.S. Department of Education (2009) echoed this desire for the use of data to increase academic achievement by calling upon schools and educators to use assessment data to respond to students' academic strengths and needs. "Data provide a way to assess what students are learning and the extent to which students are making progress toward goals. However, making sense of data requires concepts, theories, and interpretative frames of reference" (Hamilton et al., 2009, p. 5). According to Hamilton et al. (2009), although more data are available in schools, the question of what to do with the data remains. "Philosophically, it is easy to see that when children lead their own learning, they can become more responsible, motivated, and involved in their education" (Wierda, 2015). Wierda noted that the use of data tracking and a data notebook could lead to increased student achievement and could be a positive addition to a student-centered approach in classrooms. Hamilton et al. (2009) provided recommendations of making data part of an ongoing cycle of instructional improvement by collecting and preparing a variety of data about student learning and recommendation of teaching

students to examine their own data and set learning goals: “Teachers should provide students with explicit instruction on using achievement data regularly to monitor their own performance” (p. 19). There is little research on how student achievement is affected when students collect, chart, and track their own learning data. This quantitative study on the relationship between students’ tracking their learning data and academic achievement provides research to add to the current literature related to student achievement through assessments, goal setting, and data collection and tracking.

Purpose Statement

The purpose of this correlational study was to apply the theories of self-determination (Schunk, 2016) and attribution (Ryan & Deci, 2000) by measuring the effect of students’ tracking of their own learning data on academic achievement for fifth-grade students at a public middle school system in the southeastern region of the United States. This study should be able to provide insight into the relationship between students’ tracking of their -own learning data and academic achievement. This may provide educators with an instructional strategy, such as student data notebooks, to help students become more self-regulatory learners. It may also provide teachers with the tools and strategies to focus on the standards needed for mastery and a means to increase student achievement.

Significance of the Study

The study was deemed significant and relevant to the field of education, specifically student data tracking and academic achievement. The study allowed school administration, teachers, and fifth-grade students at a public middle school in the southeastern region of the United States to access student learning data collection strategies that impact overall academic achievement. The use of students’ tracking of their learning data allowed the focus on

increasing student ownership of learning and increased achievement.

Academic achievement is defined as the accomplishment of anticipated instruction objectives against preset standards (Kellough & Jarolimek, 2008). The participating school served students that are being raised in not just poverty, but in generational poverty. According to Lascour and Tissington (2011), poverty indicates the extent to which individuals live without resources of financial, emotional, mental, spiritual, and physical support systems. Poverty forms a certain culture and way of life that defines relationships, role models, and has implications on student academic achievement. The need for intensive intervention for all students, but especially students of poverty and low-socioeconomic status is needed for schools to ensure all students learn and achieve.

Understanding the need to effectively use student data to differentiate learning and guide instruction may positively impact the learning of all students. Blankstein (2004) stated that building this type of community is "our best hope for sustained school successes" (p. 6). As instructional leaders of the classroom, teachers will become more knowledgeable and confident in how to use the student data, which in return will build their professional and internal strength. As self-regulatory learners, students will become more knowledgeable of their own learning and what skills and standards they have and still need to master. It has been stated that teacher efficacy and belief systems affect student learning, but a student's self-efficacy, optimism, and confidence also affect academic achievement. Research has concluded that students' beliefs about required effort, their abilities, and the perceived task difficulty can determine the overall academic achievement. According to Sander and Sanders (2009), "Increasingly, the self and self-beliefs are being seen as key indices of achievement motivation" (p. 29). In students, self-beliefs affect their own academic achievement.

Locke and Latham (2002) suggested that reducing the ambiguity of what is expected and giving someone a clear goal to aim towards improves performance. This study allowed students to know what is expected, what they have mastered and where they need to continue to work towards mastery, proficiency, and academic achievement. When students set and achieve academic goals, it "gives students and teachers a sense of ownership and pride over their work" (Newman, 2012, p. 15). This ownership and pride may translate into students becoming self-directed learners. Students can communicate to others what they are learning, what the result is, and what they need to do to accomplish the result of learning. According to Newman (2012), one of the most important and interesting cultural changes seen in schools is

> the depth of conversation that takes place on all levels of curriculum and the way students are able to articulate what they are learning, what areas they need to improve in and why they are focused on a specific skill or subject. (p. 15)

These very specific and targeted discussions around student learning and data are seen between all school stakeholders. Individual data tracking can not only increase students' motivation to learn, but their academic achievement as well. This study adds to the quantitative literature of the effects and relationship of students' tracking their learning data and academic achievement.

Research Question

RQ: Is there a relationship between fifth-grade students' fidelity to data tracking via data notebooks and their overall achievement in mathematics as measured by the aimswebPlus assessment?

Definitions

1. *Assessment* – Process for gathering information that is used for making educational decisions about students, curricula, instruction, programs, schools, and educational

policy (Nitko & Brookhart, 2011).

2. *Fidelity* – The degree to which an educational intervention or model is instituted as intended (Dhillon, Darrow, & Meyers, 2015).
3. *Formative Assessment* – An assessment for learning given during instruction to facilitate learning and guide instruction (Bennett, 2011).
4. *Professional Learning Communities (PLC)* – A group of educational professionals who meet with a focus on and commitment to the learning of each student (DuFour et al., 2010).
5. *Rubric* – Evaluation tool used to promote consistent application of learning expectations, objectives, and standards or to measure work against a consistent set of criteria (Great Schools Partnership, 2013).
6. *Standardized Test* – An assessment of individual's mastery of content, knowledge, or skill that is administered and scored under standardized conditions that specify the specifics of test administration. Questions, test administration conditions, scoring, and data interpretation are consistent (Gawthrop, 2014).
7. *Summative Assessment* – Given periodically to determine at a point in time what students know and do not know (Garrison & Ehringhaus, 2007).
8. *Universal Screener* – Valid, age-appropriate assessments designed for a specific academic domain such as reading fluency, decoding skills, math computation, and math reasoning (Turner, 2018).

CHAPTER TWO: LITERATURE REVIEW

Overview

This literature review provides a theoretical understanding of student motivation, goal setting, and achievement, as well as related literature on what impacts student achievement. This body of knowledge, while helpful to researchers and educators, highlights the literature gap concerning the relationship between student fidelity to data tracking of learning and student achievement. This review of literature demonstrates how motivation, goal setting, grades, and data collection influence student achievement.

Theoretical Framework

One theoretical framework for the concept of student achievement is the self-determination theory. Self-determination theory, identified by Ryan and Deci, focuses on how performance quality is affected by one's sense of well-being, initiative, and self-will. Social and cultural factors and those that support one's sense of competency and autonomy increase cognitive engagement and motivation. According to self-determination theory, students who are cognitively engaged are more invested in their own learning and are more motivated. Ryan and Deci (2000) argued that if the social context (i.e., school) is unsupportive or does not recognize an individual's needs, there is a negative impact.

Another theoretical framework that has been widely applied to the study of education is the attribution theory. Schunk (2016) defined attribution theory as how people view the causes of their behavior and the behaviors of others. The attribution theory focuses on how rules are used, how people are inclined to seek information, and how an individual's motivational beliefs, emotions, and behaviors are influenced. The attribution learning theory is relevant in the field of education, specifically, when considering its relevance to students' motivation for learning.

Teachers are in a constant state of assessing students and collecting data on their progress, especially as high-stakes testing becomes even more present in schools. This never-ending cycle of assessment and data collection is to ensure that students and schools do not fail because failure is not an option in education. Teachers work to disseminate, discuss, and create action plans around student data to guide instruction and increase achievement. Data are gathered, and many schools are data rich. However, are they data informed? Not only should teachers and administrators be aware of students' learning data, but students should also be aware. To become self-regulatory, motivated learners, students need to know what they are learning, why they are learning it, how they will know they are successful, and how they are progressing towards mastery of the learning.

As schools and classrooms become more student-centric and standards-based, the need for understanding what impacts student achievement is crucial for educators. Numerous factors can influence student achievement, such as motivation, self-regulation, time management, effort, ability, goals, grades, and perseverance. There is also a need to determine how teachers and students apply the self-determination and attribution theories to daily classroom interactions and learning. Research shows a connection between mastery and performance goals to how students think about themselves and their learning. There is evidence that for student motivation, performance, and learning to improve, students need to participate in the setting of learning goals. Moeller et al. (2012) stated, "When students do not understand the goal of a task or do not invest themselves in a task, there is a lack of ownership in the learning" (p. 155).

Related Literature

Standardized Testing

Standardized tests are designed and administered by state education agencies in order to measure academic achievement across multiple grade levels. *The Glossary of Education Reform* (Great Schools Partnership, 2019) defines a standardized test as any form of test that (a) requires all test takers to answer the same questions in the same way and (b) is scored in a consistent and standard manner, making it possible to compare the relative performance of individual or groups of students. The standardized format, computerized scoring methods, reduction of potential bias or subjective evaluation allows many test experts and educators to consider standardized testing as an objective and fair measurement of assessing academic achievement of students.

As a result of state and federal laws, policies, and regulations aimed at reforming school and teacher performance, standardized achievement tests are utilized in most public schools in the United States. Standardized achievement tests are used to improve educational effectiveness and student achievement in five primary ways: (a) holding schools accountable for educational results and student performance, (b) evaluating if students have learned what they are expected to learn, (c) identifying gaps in student learning and academic progress, (d) identifying achievement gaps within student population groups, and (e) determining if educational policies are effective and working as intended (Great Schools Partnership, 2019).

In standardized testing results, the learning gap and achievement gap refers to persistent and significant disparity in educational attainment or academic performance between different groups of students. *The Glossary of Educational Reform* (Great Schools Partnership, 2019) noted the specific differences between these educational gaps. The achievement gap refers to the inequitable distribution of educational results and benefits, and the learning gap refers to

disparity in relative performance of individual students. Achievement gaps vary from group to group and can be defined by persistence and consistency of the differences in achievement among student groups.

Ansell (2011) noted that achievement gaps are often found due to differences in socioeconomic factors. According to the United States Census Bureau (Semega, Kollar, Creamer, & Mohanty, 2019), the 2018 median household income was $63,179. The 2018 real median income of Asian households was $87,194, for non-Hispanic White $70,642, Black $41,362, and Hispanic households $51,450. In 2018 the official poverty rate was 11.8%, a decrease of 0.5 percentage points from 2017. In 2018, there were 38.1 million people living in poverty in the United States. This is approximately 1.4 million fewer people than in 2017 and significantly lower than the most recent national recession in 2007. Experts have tried to determine why socioeconomic and race differences are strong predictors of educational achievement. According to Lascour and Tissington (2011), poverty indicates the extent to which individuals live without resources of financial, emotional, mental, spiritual, and physical support systems. Poverty forms a certain culture and way of life that defines relationships, role models, and knowledge and has implications on student academic achievement. Due to a lack of resources, students living in poverty and with low socioeconomic status have low academic achievement. Researchers have noted that the achievement gap is a subtle effect of environmental factors and opportunity gaps (Jeynes, 2015; Mendoza-Denton, 2014; Rigoglioso, 2013). For example, being raised in a low-income family often means having fewer educational resources and opportunities, and poor nutrition and health care (Ansell, 2011).

Standardized testing is aimed to measure student achievement and effectiveness of schools. However, according to a recent report by the Council of the Great City Schools (2015),

the average student will take over 100 mandatory standardized tests throughout his pre-kindergarten through high school educational career. The study found that tests are not always aligned to instruction and standards, do not assess content mastery, and are not in alignment with college and career ready standards. Standardized tests are administered to measure student achievement progress, but the testing data are usually not returned to schools in a timely manner. Waldman (2015) found that nearly 40% of school districts reported waiting up to four months for the test data and results, "thereby minimizing their utility for instructional purpose" (p. 2). Waldman summarized that clarity to the purpose of testing, guidelines around the amount of time spent on standardized testing, and ensuring assessments are of high-quality are needed to improve standardized testing.

Formative and Summative Assessments

Frey and Fisher (2011) shared with teachers how to create a formative assessment system and provide educators with the necessary tools to create a formative assessment system to increase teaching and learning effectiveness. Formative assessments allow a differentiated grading policy that provides data and feedback to students' progression towards mastering defined learning standards. Formative assessments bridge the gaps and reduce discrepancies between a student's current understanding or performance and the desired goal for understanding or performance. Formative assessment systems help increase not only student confidence but also student motivation.

Formative and summative assessments are effective in advancing students' achievement and have become crucial components of schools' professional learning communities. According to Frey and Fisher (2011) there are three steps that are required to reach high levels of learning in the feedback and formative assessment system. First, students must know the purpose for

learning. Secondly, stakeholders must receive timely communication and quality feedback of student learning and progress. Lastly, instruction and learning must be guided by data.

Munzur (2014) provided insight into how the absence of summative assessment and grades impact students' motivation and learning. Grades are the visible and external representation of what learning has occurred. According to Munzur the grade received on an assignment or assessment not only assesses what the student knows, but it also provides motivation for the student's learning.

Munzur (2014) found that the use of summative assessments increases student motivation and subsequently leads to a high probability of learning and achievement. Summative assessments clearly communicate to students their learning progress and provide them with the information needed to continue to learn. Munzur stated, "The given feedback provides them to see their strengths and weaknesses which will keep them working to improve their skills" (p. 74). The absence of a summative assessment leaves the students feeling uncertain and that they are coming to school for nothing; therefore, formative and summative assessments play an effective role in student motivation and achievement.

What Affects Academic Achievement

When learning opportunities and activities are emphasized, students are more intrinsically motivated. "Positive outcomes result when social environments satisfy children's natural desires" (Schunk, 2016, p. 380). Research shows that engaging in a task that is of intrinsic appeal and interest for an extrinsic goal can negate the intrinsic motivation—that is, the motivation can decrease. Students engage in activities that are both intrinsically and extrinsically motivating. According to Schunk (2016), "Many students like to feel competent in school and experience pride for a job well done, but they also may desire teacher approval and good grades"

(p. 384). The competence and pride are intrinsically motivating for students where approval and good grades are more extrinsic motivators. Schunk (2016) stated, "To ensure an optimal level of motivation, students need to make facilitative attributions concerning the outcomes of achievement behaviors" (p. 366). When students have a distorted judgement about their ability, the importance of effort, and the role of the teacher and other stakeholders in education, it can lead to low levels of motivation and learning. Academic achievement is affected by teacher and student mindset, student motivation, intrinsic and extrinsic factors, as well as the collaborative environment of the school.

DuFour et al. (2010) contended that one of the most effective ways to improve student achievement is the following: (a) Gather information surrounding current levels of student achievement. (b) Develop instructional strategies to address areas of weakness in student learning. (c) Implement and measure the impact of these instructional strategies over time. (d) Apply any new learning and knowledge in a cycle of continuous and ongoing improvement.

Hattie's (2009) book *Visible Learning* confirmed these recommendations. Hattie reviewed nearly a thousand of pieces of literature on the strategies and practices that positively impact student achievement and affirmed the work of DuFour et al. (2010) as being one of the most effective ways to improve student achievement. The conclusions clearly align with the foundational premises of PLC: identifying what students should know, how teachers will know when students have learned what is expected, and how teachers will respond when students do not learn what is expected (DuFour & Eaker, 1998).

Hattie (2009) also noted that learning goals and action plans affect student achievement by not only including defined steps, but also including ways to reflect through specific feedback. Hattie stated,

> It was only when I discovered that feedback was most powerful when it is from the student to the teacher that I started to understand it better. When teachers seek, or at least are open to, feedback from students as to what students know, what they understand, where they make errors, when they have misconceptions, when they are not engaged-then teaching and learning can be synchronized and powerful. Feedback to teachers helps make learning visible. (p. 173)

Hattie (2009) also suggested that self-reporting of student grades is the most powerful strategy out of 138 instructional practices he examined. This critical piece of communicating students' strengths and weaknesses happens through monitoring the learners' progress and providing specific feedback.

A recent publication by educational specialists Marzano et al. (2014) titled *High Reliability Schools* is based on the research of Weick and Sutcliffe (2007) surrounding high reliability organizations (HRO), Hattie's (2009) research surrounding high effect sizes in the school setting, Hattie and Anderman's (2012) research on student achievement, and DuFour and Marzano's (2011) work surrounding PLCs. Marzano et al. identified high reliability schools leading to academic achievement through five levels:

1. Safe and collaborative culture
2. Effective teaching in every classroom
3. Guaranteed and viable curriculum
4. Standards based reporting
5. Competency-based education

The first level, safe and collaborative culture, is foundational to high reliability within schools. After achieving Level 1, each level in the hierarchy is dependent on the establishment

of the previous level. For example, effective teaching in every classroom (Level 2) is dependent on first having a safe and collaborative culture (Level 1). Marzano et al.'s (2014) work also described critical components within each level, with the single critical component for a safe and collaborative school culture being the implementation of the PLC process. This initial level, which surrounds the implementation of a PLC, is foundational to the entire high reliability school's framework.

Types of Grading Practices

One type of grading policy that many schools are incorporating is mastery learning and grading, also referred to as grade for learning. Eppich, Hunt, Duval-Arnould, Siddal, and Cheng (2015) found that mastery learning is an effective educational strategy that uses deliberate and intentional practice with timely and detailed feedback that promotes increased performance and achievement. The authors stated that with mastery learning students gain skills and knowledge of predetermined standards for learning that are rigorously measured and assessed against those standards. The strategy of mastery learning allows for differentiated and individualized time frames for learners to reach the same expected outcomes (Eppich et al., 2015). Thompson and Grabau (2004) investigated how mastery learning and providing students with opportunities to determine their own paths to success affected motivation and learning. Mastery learning is a rewarding strategy to encourage greater student achievement by providing multiple attempts to demonstrate understanding and mastery of course content and learning standards. The purpose of their study was to provide students in two introductory science courses in the College of Agriculture at the University of Kentucky with options-based grading to determine if providing them with choice in grading would allow them to work towards their own strengths and learning goals.

For educators, there are two goals at the heart of student motivation, one being learning goals or mastery of content and the other being performance goals or the grade assigned to the learning. Thompson and Grabau (2004) implemented a style of mastery learning that includes requiring students to complete a minimum number of assignments to show mastery of the concept and giving students the option to complete additional work to increase learning and improve their grades. In their study, they found student perception of the mastery learning was favorable. Unfortunately, many students did not take full advantage; they did not do the additional work to demonstrate further learning or to improve their grade.

Minimum grading is another different grading policy used in many schools and classrooms. Minimum grading is a practice where schools assign a predetermined minimum grade, for example a 50%, in efforts to decrease drop out and failure rates. Traditional grading scales rank student progress from above average or advanced (A), to average or proficient (B/C), to below average or below basic (D/F). The practice of minimum grading was implemented to convey a student's progress is below basic while providing the possibility to recover and make adequate growth to pass the nine weeks or semester course. Grading policies and reporting of grades are tools used to communicate the work and progress of students. Therefore, educators often debate if this practice adequately communicates a student's progress, because it does not truly communicate the actual grade but an inflated grade.

Carey and Carifio (2012) reported on the results of a quantitative study on minimum grading data. The researchers showed that grades affect student interest, confidence, self-efficacy, and motivation. The results also showed that minimum grading is a low-risk strategy based on sound educational and psychological theories that do not induce social promotion or inflated grades but can affect student motivational responses to learning.

Teacher Grading Decisions

Kunnath (2017) stated, "Experts are in agreement that grades largely fail to accomplish their main purpose in communicating student academic achievement" (p. 68). Throughout the educational landscape, one function of assessments and grading is not only to communicate progress but also to motivate students to perform better and work harder. Elikai and Schuhmann (2010) investigated the impact of lenient grading scales versus strict grading scales. The authors discovered that the difference in lenient and strict grading policies have a clear and different impact on student learning and motivation.

When expectations and requirements for learning are assessed through a strict grading scale, student motivation is increased. The results of Elikai and Schuhmann's (2010) study showed that an attainable yet strict grading policy can be an important technique in motivating students and increasing achievement. Standards-based grading measures student proficiency on a specific set of learning outcomes or standards. The learning standards and mastery scale, or rubric, are shared with students at the beginning of the course. Throughout the learning, students' progress towards mastery and proficiency is tracked based on learning tasks or assessments that are aligned to the learning standards. Standards-based learning and grading encourages student ownership of their learning and allows communication and dialogue about student progress and learning through teacher feedback. The goal of standards-based grading is to align instruction to assessed standards and clearly communicate them to students and parents as a way to increase academic achievement.

To accurately provide student performance data, the criteria for success must be clearly stated and known by students and teachers. Mastery or success criteria are concrete examples and explicit descriptors of what student mastery looks like (Moss & Brookhart, 2012). In order

for students to meet the criteria of mastery expectations, Popham (2008) suggested that students should be included in the defining process of what quality, or master-level work, looks like. The movement to the use of rubrics and standards-based grading allows all stakeholders to see where the gaps are in student learning or when students are progressing beyond the learning standards (Marzano, 2010). When students know the mastery criteria and where their learning gaps or needs are, they can become self-regulated learners and use this information to guide their own learning (Moss & Brookhart, 2012).

Walters, Silva, and Nikolai (2017) stated, "Excessive pressure on academics and institutions to continuously assess and measure the progress of their students and that assessment processes reflect more the needs of policy makers than they do the needs of teachers and learners" (p. 1153). Educators cannot ignore the district or state-level assessments, but they can use the data from these assessments to provide quality instruction and ensure students are learning. Teachers and students need to collect data, and then they use the data to monitor and guide instruction and learning. According to Zimmerman, Bonner, and Kovach (1996) teachers and administrators should work on converting classrooms into areas that teach students much needed self-regulatory processes. Through strategies such as S.M.A.R.T. goal setting and student data tracking, opportunities for students to become self-regulated learners can be developed by differentiating and specializing what students need to learn and ensure that all students are making gains and learning. S.M.A.R.T. goals are written with five guidelines: (a) Specific: Define exactly what wants to be accomplished. (b) Measurable: How will one know when the goal has been reached? (c) Attainable: Can the goal be achieved? (d) Realistic: Is the goal doable, yet challenging? (e) Timely: Can the goal be accomplished in a reasonable amount of time? (Lawlor & Hornyak, 2012).

Isnawati and Saukah (2017) investigated teachers' grading decision making, with a focus on the teachers' grading beliefs and practices, types of assessments used, and factors considered in making decisions about grading. The researchers found that the teachers believe that grading practice and assessments are not only used for measuring student ability and mastery of content, but also reflect the student progress towards becoming active users of language, life skills and experiences, and motivation. They also determined teachers consider formal and informal assessment achievement data in grading decision making, as well as the non-achievement factors like achievement and behavior. Tierney (2015) discovered there are also moral reasons that affect teachers' grading decision making. When teachers use altered grading practices, the moral reasons that underlie the decision include compassion, empathy, intention of teaching life lessons, and a desire to provide students with opportunities. Teachers utilize a process when reviewing and scoring student work and include factors of mastery achievement and effort when calculating and making a final grade decision (Isnawati & Saukah, 2017; Tierney, 2015).

According to Reeves (2017), there are five big myths or misconceptions about grading. The first myth is that grades motivate students. For teachers and school administrators, grades were likely huge motivators when they were in school, but for today's students that is not the case. Decades of research on the efficacy of grades as motivators does not show high levels of overall diligence, engagement, and assignment completion, which is to be expected if grades were effective motivators (Marshall, 2017).

The second myth that Reeves (2017) confronted is that when teachers grade homework and assign practice assignments it improves achievement. Reeves (2017) stated there are three major problems with this misconception. First, for grading homework and practice to be an effective strategy for academic improvement, students would need to receive continuous

feedback and work beyond their current limits and levels of performance, which is difficult when doing the work at home. Second, the grading of homework or practice does not encourage students to push themselves into the challenge and productive struggle needed to improve achievement. As with most homework assignments, all students are completing the same assignment and the feedback is not as meaningful or differentiated to increase achievement of the individual student. The attached grade makes many students focus on the completion of the assignment and turning it in on time, as that is the feedback that is mostly received. Lastly, it is simply unfair and decreases motivation for a final grade to drop due to homework and practice. The third myth is that grades drive future performance. There is a positive correlation between good grades and college and career success as well as between poor grades and school dropout rates.

The fourth myth is that punishment deters unwanted behaviors. Reeves (2017) referenced the practice of corporal punishment to support the debunking of this myth. The researcher showed that the use of corporal punishment does not change behaviors; it has the opposite effect and breeds antisocial and aggressive behaviors. When teachers assign punishment for late, incomplete, or missing assignments, it punishes students for work ethic or effort and does not truly reflect students' ability, learning, or mastery of content. This practice leads to a downward spiral for students' academics and behaviors. Reeves (2017) stated that students are doomed for failure before the semester is over and become disruptive, skip class, and ultimately drop out of school because of a punitive grading system, rather than building momentum and finishing the semester strong.

The fifth myth is that it is acceptable for teachers to have their own grading systems. If teachers across the same school or district have their own grading system, they would come up

with different final grades for the same sequence of student grades. The final averages would differ based on the individual teacher grading system such as if missing work was recorded as a zero, if the final exam was considered as the ultimate grade measure, or if grades are weighted. Reeves (2017) ascertained that it is not fair when a student produces the same quality work and work ethic in different content classes, yet the grade in each class differs based on the teacher. Grading systems are matters of equity, and equitability cannot occur when teachers implement their own grading policy or system.

Grades Affecting Motivation

Kunnath (2017) surveyed a sampling of 125 high school core teachers and 15 teachers that participated in four focus group interviews. The surveys and focus group interviews provided data on the influences, rationale, and practices of the decision-making process for grading. Kunnath identified three influencers and two components of teacher rationale for grading decisions. The three teacher rationale influencers were teacher philosophy on teaching and learning, concerns over external perceptions, and pressure from administration on assigning low grades. Teacher grading decisions were also driven by the two components of teacher rationale: desire to promote student understanding and student motivation and engagement. Cheng and Sun (2015) explained that teachers who support these beliefs often consider the future consequences of student grades. Kunnath also identified that teachers use factors of students' effort, ability levels, and achievement in their grading practices. Kunnath's (2017) study found that teachers seek to identify inequality issues in the classroom and use grades as one way to address the inequality. Even though teachers were acting with the best intentions for students, this practice is subjective and not objectively based on student work and leads to further grade inflation. The grading practice of issuing a student report card is still a widely used practice in

K–12 schools across the country and is a daily role and responsibility of teachers. However, Kunnath stated, “Experts are in agreement that grades largely fail to accomplish their main purpose in communicating student academic achievement “(p. 68). Teachers, parents, and students alike place a large emphasis on summative assessments and report card grades. The letter grade or report card grade does not always communicate to teachers, parents, and students what the students know, have learned, and mastered, and what they still need to work on. Kunnath concluded, “Failure to use grades for their primary purpose leaves educational stakeholders largely uninformed about students’ true level of learning” (pp. 68–69). Kunnath’s research provides more insight into teacher grading decisions and policies than how these grading polices impact student motivation and learning.

Carey and Carifio (2012) conducted a quantitative study on minimum grading data. The practice of minimum grading, assigning a 50 or other predetermined failure grade as opposed to the true failure grade, was implemented to convey a student’s progress is below basic while providing the possibility to recover and make adequate growth to pass the nine weeks or semester course. Findings from Carey and Carifio’s study indicated that grades affect student interest, confidence, self-efficacy, and motivation. The results also showed that minimum grading is a low-risk strategy based on sound educational and psychological theories that does not induce social promotion or inflated grades but can affect student motivational responses to learning.

Elikai and Schuhmann (2010) examined the results of student effort communicated by grades on an assignment or end-of-course grades to determine the motivational responses, if any, by students. The researchers wanted to gain insight into the impact of lenient grading scales versus strict grading scales. They found a strong correlation between higher grading standards

and enhanced student motivation and learning outcomes. Students held to a strict grading scale put forth greater effort and acquired a better understanding of the material. Elikai and Schuhmann stated, "One could argue that higher grading standard may motivate some students to work harder to achieve high grades and at the same time serve as a disincentive to other students who may now 'give up' when faced with stricter standards" (p. 679). The report *Grades vs Learning - Shifting Attention to What's Important* noted that many students use academic achievement in the form of grades as a basis for their sense of self (Graide Network, 2018). Student sense of self and motivation grounded in grades is part of a larger educational issue: the source of academic motivation. When students rely on extrinsic incentives such as praise and grades, the intrinsic motivation to learn for one's self growth is lost. The use of grades to drive motivation is not only counterproductive for students emotionally, but there is also evidence that it can have the adverse result and their academic progress can be negatively affected. According to the Graide Network (2018), "Most student evaluations are composed of both evaluative feedback, which 'judges student work,' and descriptive feedback, 'which provides information about how a student can become more competent'" (p. 2). The report noted that descriptive feedback grading has a greater impact on student learning and motivation.

McMillan (2003) investigated the classroom teachers' assessment decision-making process to improve instruction and student motivation and learning. The teacher's grading and assessment practices are crucial processes in developing an understanding of what students know: a measurement of classroom learning. McMillan found that external demands, district level mandates, and high stakes assessment often conflict with teacher values and beliefs. These demands are beyond teacher and student control, but they often impede students from truly being motivated to learn and succeed. Even with all the external and high stakes demands, McMillan

found that teachers still make grading and assessment decisions that will enhance student learning, student engagement, and motivation to learn in the classroom.

Motivation and Achievement

Several types of motivators play a role in students' learning. The definition of motivation in essence is simply wanting (Souders, 2019). Motivation is the wanting for a change in behavior, thoughts, feelings, self-concept, environment, and relationships. Teacher efficacy and belief systems affect student learning, but a student's self-efficacy, optimism, and confidence also affect motivation and achievement. Researchers conclude that students' beliefs about required effort, their abilities, and the perceived task difficulty could determine the overall academic achievement. According to Sander and Sanders (2009), "increasingly, the self and self-beliefs are being seen as key indices of achievement motivation" (p. 29). Self-beliefs affect goal and academic achievement in students.

Intrinsic motivation refers to a student's desire to learn or engage in a task for no other reward but the task itself. In contrast, extrinsic motivation is the desire to engage in a task as a means to an end (Schunk, 2016). Social context and environmental factors play a substantial role in extrinsic motivation. Most individuals are motivated by goals, values, and desires to experience specific emotions associated with certain end-results (Reeve, 2015). The goal of learning or completing a task is a valued end with extrinsic motivation. One view of intrinsic motivation is mastery motivation. When learning opportunities and activities are emphasized, students are more intrinsically motivated. "Positive outcomes result when social environments satisfy children's natural desires" (Schunk, 2016, p. 380). Researchers argue that engaging in a task that is of intrinsic appeal and interest for an extrinsic goal can negate the intrinsic motivation (i.e., the motivation can decrease). Students engage in activities that are both intrinsically and

extrinsically motivating. "Many students like to feel competent in school and experience pride for a job well done, but they also may desire teacher approval and good grades" (Schunk, 2016, p. 384). Motives express themselves through behavior, engagement, psychophysiology, and brain activations and have a positive contribution to significant life outcomes like achievement, performance, and wellbeing (Reeve, 2015). Competence and pride are intrinsically motivating for students where approval and good grades are more extrinsic motivators.

Confidence is defined as having a firm trust in one's ability in a given task. Goal achievement is affected by confidence as well as optimism. Wesson and Derrer-Rendell (2011) stated that "a lack of confidence in one's ability to succeed on a task will lead to low expectations for the outcome of the task, whereas one will have higher expectations for the outcome of tasks felt to be achievable" (p. 5). Research has focused on more general construct of students' confidence as related to their academic self-concept. According to Sander and Sanders (2009), academic confidence is the confidence of a student concerning how he or she will respond to the demands of higher-level studying. When looking at variances in achievement, confidence accounts for 46.3% of total variances, in comparison to all other cognitive and non-cognitive variables (Stankov, Morony, & Ping Lee, 2014). Students' academic confidence directly correlates to how they approach studies, learning, and content. Along with optimism and confidence, academic confidence seems to be relevant to students' goal setting and academic achievement.

Ability is defined as competence in doing. Students sometimes set inappropriate or unmotivated goals, adopt self-defeating strategies, or give up altogether based upon these beliefs about ability and learning. At the elementary level, students seem to believe that effort and ability are the same as intelligence. Hoy and Hoy (2013) supported this belief of younger

students and stated, “Smart people try hard and trying hard makes you smart. If you fail, you aren’t smart and you didn’t try hard” (p. 159). Middle school students, around the age of 11 or 12, begin to differentiate between ability, effort, and academic performance. Hoy and Hoy (2013) stated, “About this time, they come to believe that someone who succeeds without working at all must be really smart” (pp. 159–160). This stage of education is when motivation is highly influenced by ability beliefs.

Most students recognize that learning is important, but they still are not motivated by academics or possess a desire to succeed. In a publication by the Center on Education Policy (2012) entitled *Can Goals Motivate Students?* the authors explored issues related to students’ motivation to learn. The publication indicated “that if learning were reframed as a means to achieve a certain goal, these students would be better able to see its value” (p. 1). For some students having a certain end goal is enough motivation. Some students are motivated by setting short-term, concrete goals, content-specific goals, long-term goals, or abstract goals. Findings indicated that there are four dimensions of motivation: (a) competence, (b) control/autonomy, (c) value/interest, and (d) relatedness. These four dimensions of motivation are a crucial part of goal setting and student achievement. “To feel competent, students need to see their goals as realistic and achievable” (Center on Education Policy, 2012, p. 2). The second dimension of control/autonomy requires the students to set goals themselves or internalize goals for themselves if set by someone else and to see a clear path to achieving the goal. The last two dimensions involve more of the learning community: “Student support for the goal will also foster interest and value” (Center on Education Policy, 2012, p. 2). Student support should come from the learning community: teachers, parents, and other stakeholders. The dimension of relatedness comes from what the students perceive as social importance, how they will be judged

by society, and what goals their peers are trying to achieve. The types of goals and how goals are set are effective motivators and have implications for academic success.

Rukavina, Zuvic-Butorac, Ledic, Milotic, and Jurdana-Sepic (2012) have researched how motivational learning environments impact student attitudes. As students are actively engaged in learning activities, the level of student participation and positive attitudes towards the learning increases. The researchers stated, "Student active engagement in the classes (in mental and physical terms) which is regarded as a condition essential for developing interest, understanding, and long-term knowledge" (p. 7). From this study, there is evidence that motivated students use intentional cognitive strategies and increased positive beliefs and attitudes. The findings suggested that after students participated in learning activities within a motivational environment, students had increased engagement. Even within motivational learning environments that lead to positive student attitudes and greater student engagement, persistence is needed to ensure increased learning and achievement. Oxford Learner's Dictionaries (n.d.) defines *persistence* as the continued efforts to further an activity even in the face of challenges and difficulties. Most studies on academic persistence consider a student's continued academic progress in terms of assignment completion rates, grade or course completion, and advancement to the next academic level (Mutlu & Yildilim, 2019). The researchers stated that these persistence indicators emphasize a more analytical look, whereas persistence may be more of an abstract construct based on students' goal-oriented behaviors and willingness in doing a task or assignment to lead to academic achievement.

Setting S.M.A.R.T. Goals

It has been supported through research that goal-setting increases motivation and achievement. The most crucial piece towards reaching goals and academic achievement is to set

clear and effective goals. Clear goals ensure learning through an increase in persistence and self-efficacy and a decrease in anxiety and frustration (Schunk, 1990). For example, in Schunk's study, elementary school students were provided with instruction to complete mathematical operations and opportunities to practice solving problems. One group of students was given a specific goal of a number of problems to complete, whereas another group was given a general goal to work productively. The students that received the more specific learning goal showed higher self-efficacy and achievement. Not only should goals be specific, they should also be measurable, attainable, relevant, and timely (Lawlor & Hornyak, 2012).

While examining the relationship between goal setting and motivation, Dr. Edwin Locke explained that employees are motivated when clear goals are given. In 1990, Locke worked with Gary Latham to develop five fundamental practices of effective goal setting (Locke & Latham, 2002). In the exploratory study by Cao and Nietfeld (2007) both qualitative and quantitative data were collected to document students' goal setting and perception of the importance of study strategies. In class, students were asked to set specific goals for learning and performance outcomes. The data from the study indicated that students were aware of test performance in relation to their performance expectations. As the semester progressed, students became realistic in setting and adjusting performance goals and estimating their test performance. The findings indicated that student learning and performance goals were maintained once set and had an impact on test performance and their achievement.

Goal setting can vary between long-term and short-term goals. Regardless of the timeframe associated with the goal, it is important to set realistic learning goals. Realistic and specific learning goals allow students to focus on learning objectives and the subskills inside of an objective. Progress towards a learning goal can be measured using rubrics or mastery criteria.

Rubrics often delineate the mastery criteria into levels of advanced, proficient, basic, and below basic. Goals are synonymous with motivation; in fact, many definitions of motivation include goals. Souders (2019) stated, "The essence of motivation is energized and persistent goal-directed behavior" (p. 1).

Goal Setting and Student Achievement

Goals are defined as the achievement an individual is striving to accomplish. Hoy and Hoy (2013) stated, "Goals motivate people to act in order to reduce the discrepancy between 'where they are' and 'where they want to be'" (p. 147). According to Hoy and Hoy, there are four main reasons goal setting improves student academic performance. First, goals focus the attention to a specific task at hand. Second, goals increase effort; that is, the harder the goal the more the effort, to a point. Third, goals increase persistence; students are less likely to get distracted or give up when they have goals. Fourth, goals promote new strategies to develop when previous strategies do not work. Students are more likely to work toward a goal, which improves their achievement, when the goals are clear, specific, reasonable – yet challenging – and attainable within a shorter timeframe. Hoy and Hoy (2013) emphasized that although goals need to be set in the classroom, teachers should not focus on performance goals that encourage a focus on high grades, competition, and student performance. The classroom goal structure should be designed with an understanding that the goal is to learn and improve in a challenging classroom community.

Goal setting provides a strategy in schools that fosters a culture of shared leadership to ensure student achievement. Newman (2012) stated, "Goal setting is about sharing leadership between the principal, teachers and students in determining one of the most important aspects of school—setting goals that determine the roadmap for increasing student achievement" (p. 13).

The learning curriculum is one area that connects principals, teachers, and students; therefore, it is where goal setting should be based. Newman stated that goal setting is the first step, but not the last, in changing the way teaching and learning occurs for students to achieve success. He stated, "We also need to ensure the goals connect with our most important stakeholders—our students" (p. 13). Individual goals are set by students where the students are involved in determining what they need to achieve personally to strive for success. Goal setting is one of the most important and powerful strategies to make a school more successful, develop connections between all stakeholders, shape the practice of shared leadership, and to achieve results. According to Newman, "Levels of goal setting are powerful tools when used to connect the work of improving student achievement across the school" (p. 13).

Burns, Martin, and Collie (2018) studied the adaptability and personal best goal setting of students. The study indicated that social support from peers, parents, and teachers, personal self-efficacy, adaptability, and teacher support significantly predicted student gains in personal best goal setting, and that personal best goal setting significantly predicted gains in student academic engagement and achievement. As discovered in this study, goal setting allows students to become more invested in their learning, knowledgeable of their areas of mastery and need for improvement and dedicated to their personal learning needs.

For goals to be incorporated in the classroom and have an impact on student motivation and learning, goal setting must be explicitly taught and integrated into the classroom structure. In a study by Rowe, Mazzotti, and Ingram (2016) on the effects of goal-setting instruction on academic engagement of at-risk students, they found a positive relationship between goal setting lessons and student academic engagement. The teachers who participated in the study stated that the integration of goal setting lessons into the general education curriculum was easy and would

be beneficial for at-risk middle school students. Based on results of the study, findings support goal-setting theory and provide additional evidence that embedding goal-setting within the general curriculum can be an effective strategy for improving and promoting students' active academic engagement. Short-term goals are more effective for uninteresting activities as the frequent feedback on progress increases commitment, which further reinforces the effort to persist and complete the activity or task (Reeve, 2015). Providing clarity of goals and choice in how to complete the task can increase the motivation and engagement to perform the more routine or uninteresting tasks. Satisfying the basic psychological needs of a sense of mastery and autonomy occurs when clarity and choice are provided and leads to overall increases in motivation and completion of goals (Souders, 2019).

The Need for Professional Learning Communities

A professional learning community (PLC) is one that places a focus and a commitment to the learning of each student. As educators design and plan for instruction to ensure student-centric, standards-based instruction, assessment, and achievement, the use of PLCs among the teachers is part of the environment focused on achievement. When PLCs are established with the focus on and belief in student learning, students can and will succeed. Blankstein (2004) stated, "In education, a huge collection of research supports the belief system of teachers heavily influences their students' possibilities for success" (p. 18). Educational stakeholders need to ensure that the learning goals are clear and widely shared; a PLC helps develop and share these goals.

Regarding PLCs, DuFour et al. (2010) stated, "This commitment to high levels of learning for all students is the core mission of schools. But how does a school move beyond the pleasant platitudes of a generic mission statement to a culture in which learning is at the center of

the day-to-day work of schooling?" (p. 6). The use of PLCs and student data to set learning goals allows schools to allocate time, resources, and human capital to what is truly important—student achievement. The need for PLCs allows schools to effectively focus on student motivation, goal setting, and achievement. PLCs are like the "brick and mortar" that build and support the learning environment. According to DuFour et al. (2010), "Members of a PLC recognize they cannot accomplish their fundamental purpose of high levels of learning for all students unless they work together collaboratively" (p. 20).

In a study on PLCs and teacher motivation, Prevo (2014) concluded that student achievement and teacher motivation are increased when the necessary time is invested in professional relations within the school. PLCs are only as effective as the team's collaboration. DuFour et al. (2010) stated, "The quality of work in professional learning communities depends, to a great degree, on the quality of collaboration that is embedded into a school's culture" (p. 20). Vescio, Ross, and Adams's (2008) review of research on PLCs and the impact on teaching practice and student learning indicated that there is a positive relationship on both teaching practices and student learning when well-developed and effective PLCs are implemented. Bolam, McMahon, Stoll, Thomas, and Wallace (2005) found that in effective PLC the "pupil learning was the foremost concern" (p. 146) and that highly developed PLCs showed stronger connections between student achievement and the professional learning of teachers.

Educators were provided even more clarity to the PLC model in a report titled, *What is a Professional Learning Community* (DuFour, 2004). DuFour encapsulated the major PLC foundational ideas while maintaining his focus on practitioners and supporting the "how" of PLCs. DuFour provided educators with a framework called the "three big ideas." Idea number one is to ensure all students learn, and "learning for all" mission statements have become

increasingly popular in educational organizations. PLCs focus their time, efforts, and energies in focusing on the learning of all students, regardless of academic achievement levels. PLCs ensuring learning for all students are commonly guided by three questions: (a) What does our school want all students to learn? (b) How will we know when they have learned it? (c) How will we respond when students struggle? In most instances, the third question separates a high functioning PLC from a PLC merely in name only. In a high functioning PLC, responding to struggling students is timely, supported by data, and based on systematic interventions. In addition to embracing learning for all students, PLCs aim to create, foster, and ensure a culture of collaboration among educators, which is the second big idea.

In an extensive five-year case study of a rural high school, Chance and Segura (2009) offered additional advice for creating and fostering collaboration within school organizations: (a) scheduled time within master schedules for teacher collaboration; (b) highly structured and focused use of collaboration time; and (c) leadership focused on student achievement and teacher accountability. Creating a climate of collaboration and a high-functioning PLC is a process requiring determination and perseverance (Kiefer-Hipp, Bumpers-Huffman, Pankake, & Olivier, 2008).

Lastly, another tenant of DuFour et al.'s (2010) PLC framework is the focus on results. Phillips (2003) conducted a three-year case study of a middle school that was engaged in PLCs. The focus of the PLCs was to better support persistently low-achieving students. At the beginning of this case study, 50% of students were proficient in the state's math, reading, writing, social studies, and science assessments. At the conclusion of Phillips's study, the rate of students proficient in math, reading, writing, social studies, and science state assessments had risen to 90%. While PLCs are certainly concerned with instructional practices and pedagogies,

the focus for educators in PLCs is the effectiveness of student learning. PLC school improvement goals go beyond program adoption, student discipline, or staff climate and culture and move toward a laser focus on improving student achievement levels. Furthermore, within an operational PLC, teams of educators systematically meet to gather, analyze, and discuss student achievement data to drive improved instructional practices (Marzano et al., 2014).

Student Data

There are many types of data that support student learning. Although test scores and grades often come to mind when one mentions student learning data, student data are collected from many different sources and in many different formats. According to the Data Quality Campaign (2015), regardless of the type of data or where the data came from, to get the best, clear, and full picture of student learning and to be meaningful and useful in empowering instructional decisions data must meet the following requirements: (a) available, (b) complete, (c) relevant, (d) secure, (e) effective, (f) communicative, (g) supportive, and (h) used to improve learning. Data are used in schools and classrooms to drive instructional decisions to increase student learning. Educators use data from interventions, course grades, observations, tests, programs, student attendance, and other sources to monitor student learning and make changes in instruction to best meet student needs and increase academic achievement. In many schools, these student data are discussed in PLCs as well as data teams.

Effective data teams are a crucial component of a school as teachers work to use the student data to drive instruction and impact learning. Reeves (2019) highlighted the top five tips for effective data teams. The first tip reminds teachers to incorporate "laughter and cheer." Collaborative data teams are on a "treasure hunt" for the best instructional practices and for

students to learn. In the most effective data teams, one would hear laughter, cheer, challenges, and encouragement. Reeves (2019) stated,

> The challenges always happen in the context of this central question: What are the best practices we have and how can we replicate those best practices? Rather than embarrassment and humiliation, great data teams provide encouragement, reinforcement and innovation. (p. 1).

The second tip is to go beyond test scores. Test scores are one part of the picture when considering student achievement data. Data teams must be intentional to look at student data as well as the data measuring the work of the school leaders and teachers. Reeves' (2019) third effective data team tip states that data trump opinions. In education, many discussions are rooted in opinion, and the researcher challenged educators to develop the habit of asking which data support that opinion. Once the data are shared, the fourth tip states to focus on next steps because data teams are not just a place to report data but to use data to improve professional practice, instruction, and student achievement. The last tip is to create time for reflection. Leaders that incorporate data analysis and support effective data teams give teachers the time to consistently and frequently reflect on student achievement. Educators involved in data teams and school-wide collaborative data use, organized around clearly focused questions to increase use of student data to drive instructional decisions and increase student academic achievement, generally acknowledge the value of data to inform educational practice (Cousins, Goh, & Clark, 2006; Lachat & Smith, 2005).

Data and Student Achievement

Although there is time involved in the process of goal setting and using data to increase student achievement, the time is one of the most powerful tools for increasing student

achievement. Newman (2012) supported this idea as he stated, "Goal setting is about setting priorities and zeroing in on teaching and learning priorities. When viewed in this vein, goal setting is actually a time-saving tool that helps place everyone in charge of their own learning" (p. 13). The process of reviewing student data, discussing an area where the student needs to improve, choosing strategies to help achieve the goal improvement area, and completing a goal sheet takes the teacher and student about five minutes. However, these times taken will more than be made up because the student has "developed a clear path for success and is developing a level of ownership over his learning" (Newman, 2012, p. 15). The time taken to set student-focused and mastery goals provide direction and focus for the teacher and student. Newman stated, "This process helps the student set priorities and remain motivated and focused on specific skills" (p. 15). It not only improves learning and achievement, but it allows students to recognize their areas of strength as well as target areas that need improvement.

Armstrong and Anthes (2001), researchers at the Education Commission of the States (ECS), conducted interviews at six school districts in five states that have reputations of using data to improve curriculum, teaching strategies, and overall student success. These districts increase state assessment scores by 1 to 13 percentage points by implementing data-driven strategies. The districts all used several different strategies to track student achievement, but all acted quickly on the results of the data. As schools use data to increase student achievement, according to Newman (2012), one of the most important and interesting cultural changes seen is

> the depth of conversation that takes place on all levels of curriculum and the way students are able to articulate what they are learning, what areas they need to improve in and why they are focused on a specific skill or subject. (p. 15)

These very specific and targeted discussions are seen between all school stakeholders: student and teacher, principal and teacher, or student and principal. Not only is students' motivation increased and teaching practices strengthened, but student academic achievement is positively impacted.

Personalized Learning

A Gallup research poll strongly suggested that as students' progress through the school tiers from elementary to middle to high school, the less engaged they become (Busteed, 2013). Busteed's research found that almost eight of every ten elementary students who participated in the poll are engaged with school. In middle school, school engagement drops to almost half with six in every ten students. By the time students reach high school, only four in every ten students qualify as academically engaged. Students should become more engaged and academically motivated as they move through their education, not less. Personalized learning is one instructional strategy that could increase student engagement, motivation, and achievement.

Personalized learning can be synonymous with differentiation and individualization. The learning is more teacher directed when it is differentiated. Although these instructional strategies are valuable to the learning environment, when students are involved by co-creating learning plans with the teacher, they dictate their pacing for instructional needs, utilize multiple strategies to meet their own learning needs, and as a result often increase their academic achievement. For educators, the shift to personalization encourages and requires flexibility, so that learners become more invested in the design and outcomes of their own learning path (Bray & McClaskey, 2015).

According to Mathewson (2017), there are seven educational trends that best support personalized learning. One trend is Personalized Learning Platforms (PLP), a learning management system that unifies instructional content and online curriculum. PLP are designed

to make personalized instruction easier for teachers, allow students to work at own pace and level, and generate valuable student learning data. PLP and the data allow teachers to make connections and instructional decisions that lead to insights and improvements in teaching and learning.

Two trends that are natural by-products of personalized learning are alternative classroom designs and redefining the role of the teacher. The first trend of the traditional classroom environment of desks in rows and the teacher standing at the front of the classroom does not support or facilitate personalized learning. Classroom environments include flexible seating arrangements, incorporating natural light, areas for group, partner, and individual work, and even standing or cycling desks. The alternative classroom design supports students are they are working, learning, and growing academically and socially through personalized learning. Just as the classroom environment has changed, so has the role of the teacher, the second trend. Educators have shifted from providers of knowledge to facilitators of learning. "This is a more complicated role for teachers, who have to learn new classroom management strategies and relinquish control of instruction. It also takes more work from students, who have to be engaged participants in every lesson" (Mathewson, 2017, p. 2).

The fourth trend that has arisen in education due to personalized learning is a focus on student progress and achievement of learning standards and curriculum at the students' own pace. This trend of competency-based education allows the true measurement of learning to be student mastery of curriculum standards and competencies. However, the researcher stated that "many schools remain committed to time-based systems, reflecting the challenge inherent in implementing such a change" (Mathewson, 2017, p. 3). Educators have found project-based learning (PBL) to be a vital part of a personalized learning environment. This trend incorporates

well-designed projects that are aligned to learning standards and allow for student choice. PBL ensures that personalized learning allows students to work and learn at their own pace and at their own interest level. Mathewson (2017) noted that schools that have included PBL lessons have experienced a decrease in discipline infractions and an increase in student engagement and achievement outcomes.

The last two trends truly allow personalized learning to meet the needs of all students. Universal Design for Learning (UDL) is a trend in education that dates back to the 1990s but has a whole new meaning for education within the framework of personalized learning (Mathewson, 2017). As educators integrate UDL principles into the planning and delivery of curriculum, teachers can engage and challenge all students. UDL makes learning accessible for all students regardless of their learning style, needs, or preferences.

One way to formalize and systematize personalized learning is through personalized learning plans. This last trend in personalized learning is a collaborative plan created by students, teachers, parents, and other stakeholders that is updated as the academic growth and needs of the student change throughout the school year. "Personalized learning plans outline student goals spanning personal, academic and career realms. They help structure academic content so student learning can be directly tied to achieving those goals" (Mathewson, 2017, p. 4). The cultural shift required by schools to make the change to personalized learning and student-centered approaches to education is difficult, yet if nothing changes then nothing changes. Moving to a school environment that is conducive to personalized learning requires all stakeholders to regularly use learning data to identify student strengths and weaknesses and students to identify their learning targets and be involved in creating learning action plans (Pipkin, 2015).

Students Leading Their Learning

One strategy that allows students to manage and lead their own learning is the flipped classroom approach. In a flipped classroom, the learning focus is frontloaded as students review content and lessons at home and do the work while in class (Fulton, 2012). The teacher serves as a facilitator and students serve as the doers of the learning by showing their understanding of the lesson. Students are able to work at a differentiated pace and the teacher monitors, provides clarification and mini lessons as needed. The use of technology allows teachers and students to receive real-time data from the daily quiz checks. Fulton (2012) examined teacher data from a flipped classroom and noted increases in student learning and achievement as compared to the same content data from a traditional classroom lesson. For the data collection, the researcher considered proficiency as the number of students that scored 80% or higher on unit assessments. Fulton (2012) data showed increased proficiencies in calculus up an average of 9.8%, precalculus proficiencies increased an average of 6.1%, and in Accelerated Algebra II, there was a 5.1% increase in median test scores.

Expeditionary Learning is another approach that creates classrooms where students, with teacher support and guidance, can manage their learning and achievement. Berger, Rugen, and Woodfin (2014) characterized the Expeditionary Learning model as (a) active instructional and student-engaged assessment practices that build student ownership of learning and academic skills, (b) rigorous academic learning that is connected to real-life and meets state and local learning standards, and (c) a culture of learning that builds collaboration, critical thinking, problem solving, communication, persistence and independence in all learners.

Student-engaged assessment is a framework for both student motivation and academic achievement (Berger et al., 2014). This framework puts the students in the lead of their learning

by involving them in understanding and investing in their own learning growth. "It changes the primary role of assessment from evaluating and ranking students to motivation to learn" (Berger et al., 201, p. 4). Students become more independent learners and gain a true understanding of their learning progress through a variety of student-engaged assessment practices. According to Berger et al. (2014), the use of student-engaged assessments allows students to learn and use the language of the learning standards, set learning goals and monitor progress, identify their patterns of strengths and weaknesses, increase self-advocacy, and assess their own work with honesty and accuracy keeping the learning standards and goals in mind.

As students become leaders of their own learning, they increase their ability to take ownership and become self-directed and self-reflective learners (Berger et al., 2014). A school and classroom culture of collaboration and trust is "both a requirement and a result of student-engaged assessment" (Berger et al., 2014, p. 9). Students must first know they are respected and cared for by their teachers. Maslow (1943, 1954) first stated that people are motivated to achieve certain needs and that some needs take precedence over others and must be achieved to attend to the higher needs. The basic needs of physiological safety, love, and belonging are met in a strong schoolwide and classroom culture. McLeod (2020) stated that students with low self-esteem who do not feel they are valued and respected in the classroom will not make academic progress at a satisfactory rate until their self-esteem is strengthened. Within this positive classroom culture, the evidence of learning shifts from a single, summative, year-end source to multiple and daily collections of data and use of data notebooks to assess teachers and student learning (Berger et al., 2014). The researchers noted this collection and analysis of formative data allow both teachers and students to understand the trends of learning in order to help students and increase their academic achievement. "Thus, formative assessment can be used to

build confidence and empower student ownership over learning and growth" (Berger et al., 2014, p. 11).

Berger et al. (2014) identified that one of the strongest determents of student achievement and growth is the student's personal mindset; how much they care about the work and learning. Students become agents of their own academic growth when they themselves identify, analyze, and use their learning data. For the use of data with students to be effective, students must have a clear understanding of their starting point, believe that learning goals are accessible and achievable, and to know and understand the learning mastery criteria. Student use of data is different for all learners but is something that should happen with not about the students (Berger et al., 2014). Berger et al. (2014) stated, "Bringing data analysis into the classroom is one more example of transforming what is traditionally reserved for adults into an opportunity for student leadership "(p. 99). The researchers highlighted that the intended purpose of student-engaged assessment and use of student data is to reach each individual student and increase the learning and achievement of all students. Schools that implemented student-engaged assessment outscored other schools in 2010–2011 reading and language arts data by an average of 13 percentage points and 12 percentage points in math (Berger et al., 2014).

Summary

The educational landscape is designed to provide learning, to aid students as they fulfill their greatest potential, and to challenge and motivate students to learn. Teachers serve as facilitators of learning by providing rigorous and engaging activities, by providing timely and quality feedback, and by communicating progress through grades. Therefore, assessments, grades, progress data, and goal setting should be used not only to guide teacher instruction but

also to guide student achievement; it should have a positive and increased effect on student achievement (Bray & McClaskey, 2015; Busteed, 2013; Mathewson, 2017; Pipkin, 2015).

A gap in the literature exists. Little to no studies have been conducted to explore how student fidelity of tracking their learning data affects achievement. Research studies suggest that student engagement and motivation are connected to increased achievement. Learning engagement and motivation can increase through goal setting and choice and voice in learning, leading to increased achievement (Curtis, 2017). "Giving students a voice, providing choices, and leading students to set goals allows learners to feel that they have control or ownership over their learning" (Curtis, 2017, p. 63). Thus, this study is necessary to provide all educational stakeholders with relevant information. This study sought to discover the effects of student data tracking and the fidelity of student data tracking via data notebooks on overall student academic achievement. With a plethora of studies on motivation, goal setting, and professional learning communities, and little to no studies focused on student data tracking, this study is a much-needed addition to the empirical research currently available on the factors that affect student achievement (Chance & Segura, 2009; Curtis, 2017; Dishon-Berkovits, 2014; Hattie & Anderman, 2012; Marzano et al., 2014; Mitchell, 1982; Sasson, 2015; Vescio et al., 2008).

CHAPTER THREE: METHODS

Overview

This correlational study investigated the relationship between students' fidelity of data tracking via data notebooks and end-of-year mathematics academic achievement results on the 2018–2019 aimswebPlus assessment. The participants were a random sample of 154 students drawn from fifth-grade math classes located in a middle school in the southern region of Tennessee. Three times during the school year, participants completed an assessment of aimswebPlus, a universal screener, in Math Concepts and Analysis (CA), Number Sense Fluency (NSF), and Mental Computation Fluency (MCF). During the study, at the end of aimswebPlus assessment window, participants tracked their academic progress on the universal screener. The fidelity of students' data tracking of aimswebPlus was analyzed using a Pearson product moment correlation coefficient test. The two variables that were correlated are students' fidelity of data tracking and academic achievement in mathematics on the aimswebPlus universal screener. The results and interpretations, along with recommendations, are reported.

Design

A correlational design was used for the study. Correlation research, for educators, identifies traits or conditions that co-relate with one another. As the strength and nature of the relationship is understood, educators may be able to project future conditions, generalize findings to the population of significance is determined, and explain certain related events; however, correlation does not imply causation (Gall, Gall, & Borg, 2007). In this study, the researcher attempted to determine if there was a significant relationship between students' fidelity of tracking their own learning data and their overall academic achievement in mathematics. The two variables are the fidelity of students' data tracking of learning and the aimswebPlus

universal screener data. The aimswebPlus screener data is a covariate as each student will have a different score for portions of the math assessment: Math Calculation and Application Mastery (Pearson, 2018). Student data tracking was evaluated for students' fidelity according to a researcher-developed instrument, and it was analyzed in relation to end-of-year aimswebPlus scores.

Research Question

RQ: Is there a relationship between fifth-grade students' fidelity to data tracking via data notebooks and their overall achievement in mathematics as measured by the aimswebPlus assessment?

Null Hypotheses

H_0: There is no statistically significant correlation between fifth-grade students' fidelity to data tracking via data notebooks and their overall achievement in mathematics as measured by the aimswebPlus assessment.

Participants and Setting

The participants of the study were randomly selected via convenience sampling. The participants were fifth-grade mathematics students who were enrolled in a southeastern school district during the 2018–2019 school year. The school district is in a growing town south of a metropolitan city in the southeastern region of Tennessee. The county is home to 36,130 people and with cultural diversity of 18.2% African American, 69.6%, Caucasian, and 8.4% Hispanic. The median household income of the residents is $52,080 with 10.4% living in poverty. Only 21% of persons over 25 years of age hold a bachelor's degree or higher, and 89% holding a high school degree or higher. The school district serves 22 schools: three high schools, five middle

schools, nine elementary schools, three unit schools (K–12), one alternative school, and one non-traditional high school.

The fifth-grade mathematics students were enrolled at the largest middle school in the school district, which serves 1,098 students in Grades 5–8. The student population's socioeconomic status consists of 60% of the student population qualifying for free/reduced lunch based on economically disadvantaged status. The school serves students with ethnic diversity of 23% Black, 17% Hispanic, 58% White, and 2% Other. Students come from urban and rural poverty, middle class, and upper middle-class families.

The use of a convenience sample for participants was appropriate for the study. The sample came from a random sampling across six fifth-grade math classes from the 2018–2019 school year. Since the fifth-grade mathematics students at this particular middle school track and record their mathematical learning data in individual data notebooks, the participants and setting are relevant. The total number of fifth-grade students during the 2018–2019 school year was 283. The total number of participants who were selected via a random number generator was 154, which exceeded the required minimum of 153 participants for a medium effect size with a statistical power of .80 at the .05 alpha level (Warner, 2013). The final sample included a total of 88 females (57.1%) and 66 males (42.9%) for a total of 154 participants. Two participants identified as American Indian or Alaska Native (1.3%), three as Asian (1.95%), 34 as Black or African American (22%), 20 as Hispanic/Latino (13%), none as Native Hawaiian or OtherPacific Islander (0.0%), 94 as White (61%), and one identified as two or more ethnicities (0.65%).

Instrumentation

To gather data for the variable of academic achievement, aimswebPlus universal screener data were used. The universal screener created by Pearson (2018) was utilized and provides quantitative data on a students' present levels of performance. At the end of the grading quarter, teachers and students participated in one-on-one data conversations. Students reviewed their individual mathematics data from the aimswebPlus universal screener. During the data conversation, participants recorded the data points and code for levels of proficiency on their individual tracker form in their data notebook. After reviewing, charting, and coding data, teachers and participants discussed how to maintain or increase the levels of achievement and set goals for the next quarter. Teachers collected the necessary data points and facilitated the data conversations; students recorded and tracked their own learning data. As participants became more self-regulatory in their learning, set priorities, and remained focused on specific learning skills, each participant "developed a clear path for success and is developing a level of ownership over his learning" (Newman, 2012, p. 15).

AimswebPlus Universal Screener

The aimswebPlus universal screener was used as a measure for the relationship of student tracking data and academic achievement. The aimswebPlus assessment was a district-wide assessment administered to students in the fall, winter, and spring of the academic school year. The assessment provided present levels of performance for students in Math Concepts and Analysis (CA), Number Sense Fluency (NSF), and Mental Computation Fluency (MCF). The assessment tool provided tri-annual data on students' present level of performance and academic achievement levels.

Present levels of performance compared how a participant scored on tested grade level standards in relation to other students in the school, state, and nation. It also showed trendlines to determine the growth of academic achievement for a participant over the course of the school year. This was known as the Rate of Improvement (ROI). ROI growth percentiles allowed for the comparison of participant progress over time and against similar students in a national sample. According to Pearson (2018), the aimswebPlus universal screener provided student scores as national percentiles and those percentiles correlated to a risk factor of not mastering grade level standards or reaching grade level achievement and proficiency levels on state standardized assessments: (a) 1–10 percentile = HIGH Risk; (b) 11–25 percentile = MEDIUM Risk; (c) 26–74 percentile = MODERATE Risk; (d) 75–99 percentile = LOW Risk.

Participants completed aimswebPlus assessments in reading and math. For this study, the math assessments of Math Concepts ad Analysis (CA), Number Sense Fluency (NSF), and Mental Computation Fluency (MCF) were utilized. Academic growth and achievement can be measured by comparing percentile scores in each assessment and by the total math battery score.

The aimswebPlus assessment was an appropriate instrument because participant scores are normed against the school, district, and nation. Participants tracked and recorded the aimswebPlus data for math on their individual data trackers for the fall, winter, and spring assessments. The aimswebPlus instrument has been used in numerous other studies (e.g., Cusumano, 2007; Feldmann, 2012; Gersten et al., 2012; Lembke & Foegen, 2009; Methe, Begeny, & Leary, 2011; O'Hearn, 2013; York, 2010) and was an appropriate measure of student grade level academic achievement.

Results of these studies showed concurrent and predictive validity of single mathematics assessment within aimswebPlus. Pearson (2018) utilized three attributes as assessment quality

indicators of the aimswebPlus assessment: validity, reliability, and fairness. Assessment quality indicator for validity stated aimswebPlus test scores can be interpreted as measures of critical basic numeracy and higher order thinking skills and concepts and can be utilized to identify academic risk, progress monitoring, and tracking of student progress towards learning goals. Assessment quality indicator for reliability stated aimswebPlus test scores are internally consistent and consistent over multiple test forms. Assessment quality indicator for fairness stated aimswebPlus test scores can be interpreted the same way for all test takers regardless of student subgroups and that the assessment is administered as intended for all students. The indicators supported identification of students at academic risk and are an accurate measurement of student progress towards grade level targets and individual learning goals. The indicators for test validity were modest, with coefficients typically from .30 to .50 (Jordan, Kaplan, Oláh, & Locuniak, 2006; Lembke, Foegen, Whittaker, & Hampton, 2008; Methe et al., 2011). Other studies showed that the predictive validity can be increased when scores from several aimswebPlus assessments, such as the three used for this study, are analyzed by a multiple regression model approach (Baglici, Codding, & Tyron; 2010; Martinez, Missall, Graney, Aricak, & Clarke, 2009).

For tests that assess participant achievement at a single point in time and are not timed, internal consistency reliability had a coefficient mean of .91 (Pearson, 2018). Among the various internal consistency methods, Cronbach's alpha was used to report for all aimswebPlus untimed measures. Concepts and Applications (CA) was the Math aimswebPlus assessment that is untimed, with a reliability coefficient mean of .80 and range of .80–.81 on the Cronbach's alpha scale. Reliability of aimswebPlus assessments for adequate consistency of measures to make academic decisions about individual student progress was met with internal consistency.

Average internal consistency of untimed math measures for students in Grades 2–8 ranged from r = .77 to .85. Average alternate forms of reliability for timed measures ranged from r = .78 to .93. Average stratified alpha for composite scores ranged from r = .90 to .92 (Jordan et al., 2006; Lembke et al., 2008; Methe et al., 2011).

Data Notebook

The primary function of educational instruments is to determine students' abilities and capacities and to offer information on which decisions can be based (Boopathiraj & Chellamani, 2013). The variable of data tracking for each participant was collected in a personal data notebook with a tracker form. At the end of each quarter, participants participated in one-on-one data conversations with teachers to review their own learning data from that quarter. Participants viewed, analyzed, and charted their data from the district's aimswebPlus universal screener at the end of each assessment window. AimswebPlus was the district's adopted universal screener administered online to all students as a tool for assessing and recording participants' progress intermittently along the continuum of the school year and their academic career. Teachers modeled and instructed the student-participants on how to appropriately complete their data tracker forms. Teachers reviewed the expectations for participant fidelity of completing data tracker forms: (a) student name, grade, and homeroom teacher, (b) key for growth followed using scores on aimswebPlus in comparison to the previous quarter, (c) performance levels colored: mastery was shaded blue, on-track was shaded green, approaching was shaded yellow, and needs support was shaded red, and (d) aimswebPlus mathematics scores for each assessment recorded in percentile scores. The data tracker was reliable as all participants and students used the same data form and recorded the same data. The data tracker was valid as it measured what it was intended to measure – participants' aimswebPlus data.

After each assessment window and after the participants had completed their assessment, teachers received the data. Student-participants then reviewed their data and recorded it on their personal data tracker forms in their data notebooks. On the tracker data form (see Figure 1), participants recorded the score and coded it to show levels of proficiency and growth along the school year continuum. For each data point, participants recorded and color coded their score and mastery shaded blue, on-track shaded green, approaching shaded yellow, and needs support shaded red (see Appendix D for sample data tracker form). The color code served as a visual of where the participant was regarding progression towards mastery and academic achievement and what standards or goals were still needed to achieve mastery and academic achievement.

The first quarter assessment data were tracked and served as the participants' baseline measure for growth. After the first quarter, participants coded scores on aimswebPlus in comparison to the previous quarter. If the data point was higher than the previous quarter, participants recorded an up arrow beside the number, if the data point was the same participants recorded an equal sign, and if the data point was lower students recorded a down arrow. The coding also served as visuals for the students as they discussed, charted, and tracked their own learning data. Participants utilized the district and school grading scale for mastery. As students recorded aimswebPlus mathematics assessment scores via their data tracker notebook, they were tracking their levels of achievement in fifth-grade mathematics.

DATA TRACKER

Name: _____ **Grade:** _____ **H/R Teacher:** _____

KEY

⇧		Positive Growth
=		Neutral
⇩		Negative Growth

PERFROMANCE LEVEL

Mastery		**Blue**
On Track		**Green**
Approaching		**Yellow**
Needs Support		**Red**

EXAMPLE

	Q1	Q2	Q3	Q4
ELA	87	97 ⇧		
Math	85	80 ⇩		
Science	93	93 =		
Social Studies				

AIMSWEB BENCHMARK SCORES

	Math
Spring 2019	%ile
Fall 2019	%ile
Winter 2019	%ile
Spring 2020	%ile

Figure 1. Data notebook tracker form. This figure is an example of the student data notebook tracker form that participants use to chart and code their aimswebPlus mathematics data.

Procedures

The researcher first secured Institutional Review Board (IRB) approval to conduct the study. The researcher then obtained permission from the Director of Schools to conduct the study at one of the district's middle schools. Once securing both the approval of the IRB and of the director of schools, the researcher conducted a meeting with the executive principal and received permission to conduct the study with the fifth-grade mathematics classes. The participants tracked data after the fall, winter, and spring assessment windows during the 2018–

2019 school year on their individual aimswebPlus mathematics assessment. These archival data were analyzed for the relationship between student fidelity of data tracking and academic achievement.

At the end of the first assessment window, teachers conducted individual data talks with each participating student. In these data talks, teachers shared data on the fall aimswebPlus screener and participants charted the data in their data tracker folders. The teachers and participants completed the data talks and data tracking process after the second quarter when winter aimswebPlus screener assessment data were available. At the second quarter data talks and data tracking, participants color coded their data to show growth (green), stagnant (yellow) or a decrease (red) from the first to second quarters. Teachers and participants continued quarterly data talks and coding of data notebooks at the end of each grading quarter. The researcher used a random number generator to select the minimum of 154 participants out of the total 283 fifth-grade students. At the end of the school year, the researcher collected the randomly selected participants' data notebooks and used the data tracker rubric to score students' fidelity of data tracking.

The expected criteria for completing the student data tracker included (a) student name, grade, and homeroom teacher, (b) key for growth followed using scores on aimswebPlus in comparison to the previous quarter, (e.g., if the data point was higher than the previous quarter participants recorded an up arrow beside the number, if the data point was the same participants recorded an equal sign, and if the data point was lower participants recorded a down arrow), (c) performance levels colored: mastery was shaded blue, on-track was shaded green, approaching was shaded yellow, and needs support was shaded red and (d) aimswebPlus mathematics scores for each assessment recorded in percentile scores. The researcher reviewed and scored each

student's data tracker form for fidelity of data tracking using the researcher-developed instrument for data tracking (see Appendix C). The researcher-developed instrument served as a tool to quantify participants' fidelity in completing the data tracker forms. The rubric was a five-point scale: (5) optimal with five expectations met, (4) above average with four expectations met, (3) average with three expectations met, (2) needs improvement with two expectations met, and (1) below average with zero to one expectation met. The rubric for data tracking was compared to participants' mathematical achievement data to determine the relationship between students' fidelity of tracking learning data via data notebooks and overall mathematical achievement as measured on the aimswebPlus assessment. During data collection and throughout the duration of the study, the researcher kept all data secured and locked in a home office cabinet and used codes when reporting the data to maintain the anonymity of the participants.

Data Analysis

According to Gall et al. (2007) correlational research refers to discovering the relationship between variables. To determine the relationship between students' fidelity of tracking their learning and aimswebPlus overall math scores, data were analyzed by employing Pearson's Product Moment Correlation Coefficient test. The required minimum of 153 participants were sought for a medium effect size with a statistical power of .80 at the .05 alpha level. Preliminary analyses were run to check for violations of the assumptions of random sampling and bivariate normal distribution. Scatterplots were used to check the assumptions of bivariate normal distribution (Warner, 2013).

CHAPTER FOUR: FINDINGS

Overview

The purpose of this study was to determine if there was a relationship between students' fidelity of data tracking and overall mathematics achievement scores, as measured by aimswebPlus during the 2018–2019 school year. The predictor variable was a researcher-created instrument to measure participants' fidelity to data tacking, and the criterion variable was overall mathematics achievement scores from the aimswebPlus assessment. Data were collected from the participants' data tracker notebooks. A Pearson Product Moment Correlation was used to test the null hypothesis. Chapter Four includes the research question, null hypothesis, and descriptive statistics and reliability for the pilot study, as well as data screening, descriptive statistics, assumption testing, and results for the main study. All data for this study were analyzed by the software package Statistical Product and Service Solutions (SPSS).

Research Question

RQ: Is there a relationship between fifth-grade students' fidelity to data tracking via data notebooks and their overall achievement in mathematics as measured by the aimswebPlus assessment?

Null Hypothesis

H_0: There is no statistically significant correlation between fifth-grade students' fidelity to data tracking via data notebooks and their overall achievement in mathematics as measured by the aimswebPlus assessment.

Descriptive Statistics for Pilot Study

A pilot study was conducted to assess the reliability analysis on interrater reliability to assess the researcher-created instrument for the variable of students' fidelity to data tracking.

Using the rubric that the researcher created, two independent raters assessed 10 students' data tracker forms. Data were analyzed with a Pearson correlation for interrater reliability. The reliability was .99; therefore, the rubric was deemed a highly reliable instrument. Descriptive statistics obtained from the pilot study can be found in Table 1.

Table 1

Descriptive Statistics of Pilot Study

Rater	*N*	*M*	*SD*
Rater 1	10	12.1	2.8
Rater 2	10	11.6	3.2

Pilot Study Reliability

The reliability of the researcher-created instrument was determined with Cronbach's alpha (Warner, 2013) which measured internal consistency and interrater reliability of the researcher-created instrument. The overall instrument's reliability was $\alpha = .78$, indicating moderately strong reliability (see Table 2).

Table 2

Reliability Statistics of Cronbach's Alpha

Cronbach's Alpha	*N* of Items
.78	3

Data Screening for Main Study

For the main study, the researcher sorted the data and scanned for inconsistencies on each variable. No data errors or inconsistencies were identified. A scatterplot was used to detect

bivariate outliers between the predictor variable and criterion variable. No bivariate outliers were identified (see Figure 2 for scatterplot).

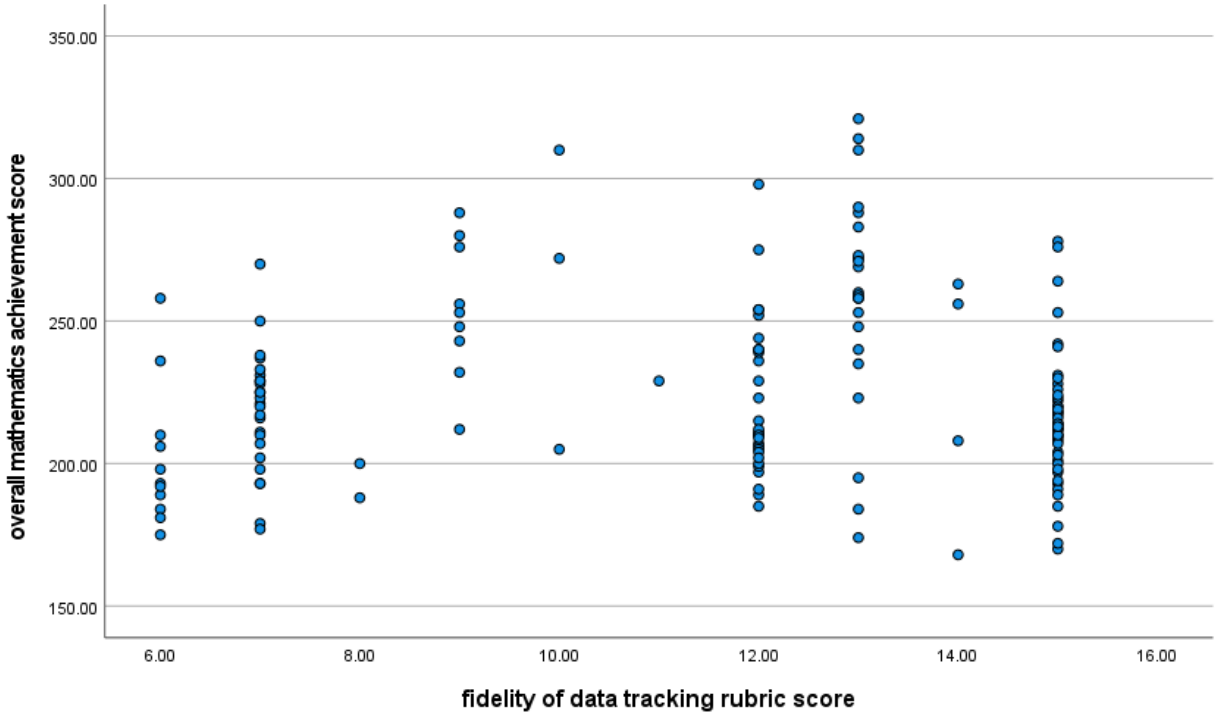

Figure 2. Scatterplot.

Descriptive Statistics for Main Study

Descriptive statistics were obtained on each of the variables. The sample consisted of 154 participants. Scores on the fidelity of data tracking instrument ranged from 6-15. A high score of 15 was deemed a perfect score on the researcher-created instrument; whereas, a low score of 6 indicated that the student only completed the information for name, grade, and homeroom teacher on their data tracker form. Overall mathematics achievement was measured using the district's screening instrument, aimswebPlus. A score in the 300-range indicated that the student was performing at or above grade level; whereas, the lower range score of 168 indicated that the student was performing well below grade level. Descriptive statistics can be found in Table 3.

Table 3

Descriptive Statistics

	N	Min	Max	*M*	*SD*
fidelity of data tracking rubric score	154	6.00	15.00	11.6169	3.22814
overall mathematics achievement score	154	168.00	321.00	225.2208	32.30983
Valid *N* (listwise)	154				

Assumption Testing for Main Study

Assumption of Linearity

The Pearson Product Moment Correlation required that the assumption of linearity be met. Linearity was examined using a scatterplot. The assumption of linearity was not met due to the curvilinear relationship (see Figure 2 for scatterplot). The Pearson Product Moment Correlation Coefficient was a robust to mild violation of the assumption of linearity, so the researcher continued with assumption testing.

Assumption of Bivariate Normal Distribution

The Pearson Product Moment Correlation required that the assumption of bivariate normal distribution be met. The assumption of bivariate normal distribution was examined using a scatterplot. The assumption of bivariate normal distribution was met (see Figure 2 for scatterplot).

Results of Main Study

A Pearson Product Moment Correlation was conducted to see if there was a relationship between students' fidelity of data tracking rubric scores and overall mathematics achievement scores, as measured by aimswebPlus. The predictor variable was researcher-created rubric scores of participants' fidelity to data tacking, and the criterion variable was overall mathematics

achievement scores. The researcher failed to reject the null hypothesis at 95% confidence level where r (152) = .05; p = .541. The effect size was small, and the curvilinear relationship was positive. There was no statistically significant relationship between the predictor variable (fidelity to data tracking) and the criterion variable (overall mathematics achievement) (see Table 4 for Pearson Product Moment Correlation test results).

Table 4

Pearson Product Moment Correlation Test

	Fidelity of Data Tracking Rubric Score	Overall Mathematics Achievement Score
Fidelity of Data Tracking Rubric Score		
Pearson correlation	1	.050
Sig. (2-tailed)		.541
N	154	154
Overall Mathematics Achievement Score		
Pearson correlation	.050	1
Sig. (2-tailed)	.541	
N	154	154

CHAPTER FIVE: CONCLUSION

Overview

The purpose of this correlational study was to explore the relationship between students' tracking of their own learning data and their academic achievement in fifth-grade mathematics, as measured by the aimswebPlus assessment. Data were analyzed using a Pearson Product Moment Correlation Coefficient to determine if there was a significant relationship between students' fidelity to data tracking and overall mathematics academic achievement. This chapter presents the findings. Results of the null hypothesis are discussed as well as how the results align with the previous literature and research. Limitations of the study are examined, and the chapter concludes with recommendations for future research.

Discussion

The purpose of this correlational study was to explore the relationship between students' tracking of their own learning data and their academic achievement in fifth-grade mathematics, as measured by the aimswebPlus assessment. The research topic was chosen because the previous research was limited in examining the relationship between students' data tracking of their own learning and overall academic achievement. The literature was unclear on how student achievement was related to students' collecting, charting, and tracking their own learning data. Hamilton et al. (2009) stated, "Making sense of data requires concepts, theories, and interpretative frames of reference" (p. 5). According to Hamilton et al., although more data are available in schools, the question of what to do with the data remains.

This study utilized the researcher-created, highly reliable instrument to assess the fidelity of students' data tracker notebooks. During the pilot study, the reliability of this rubric was $\alpha = .78$, indicating satisfactory reliability. This rubric was used as the data gathering instrument

to answer the research question: Is there a relationship between fifth-grade students' fidelity to data tracking via data notebooks and their overall achievement in mathematics as measured by the aimswebPlus assessment? A Pearson Product Moment Correlation Coefficient was used to analyze the data of the main study to determine the strength of the relationship between the variables of students' fidelity of data tracking and academic achievement. This correlational design was appropriate for this study since its purpose is to "provide information concerning the degree of the relationship between variables being studied" (Gall et al., 2007, p. 336).

For the null hypothesis, during the main study, the researcher found no statistically significant relationship ($r = .05$; $p = .541$) between students' fidelity of data tracking and overall mathematics achievement, as measured by the aimswebPlus assessment, which is contradictory to the related literature. Since no statistically significant relationship was found and after analyzing the scatterplot, a slight curvilinear relationship was noted (see Figure 2). The curvilinear relationship could have implied a relationship for some participants, or up and to a certain point, and then, it seemed that the relationship might stop or decline. This result may have occurred due to the following: (a) the 2018–2019 school year was the first year of data notebook implementation, (b) lack of teachers' fidelity to data tracking notebooks, (c) the need for more teacher and student training on the importance and purpose of data tracking and student ownership of learning, or (d) the pattern and discrepancy in fidelity rubric scores found during data collection. The researcher found that participants with consistently higher fidelity to data tracking scores were from one homeroom classroom, while those with the lowest rubric scores were all from another homeroom classroom.

Although this study provided insight to the fidelity of data tracking within fifth-grade classes and the relationship to overall academic achievement in mathematics, it contradicted the

previously presented related literature. Educators have been becoming increasingly "data rich but information poor;" that is, they are lacking information from all the collected data. Berger et al. (2104) noted that daily collection of data from multiple data sources and classroom use of data notebooks allows both teachers and students to understand the learning trends and mastery progress, and thus, increases academic achievement. There has been a great necessity to train students on how to interpret their learning data and data tracker notebooks as students become leaders of their own learning and utilize data tracker notebooks.

The reliability of the researcher-created instrument (i.e., a data tracker rubric) was determined with Cronbach's alpha, $r\alpha = .78$, indicating moderately strong reliability (see Table 3). This means that the rubric for determining participants' fidelity to data tracking was a reliable instrument and measured what it was created and intended to measure. The criteria for the data trackers, as measured by the researcher-created rubric, included the following: (a) student name labeled, (b) grade and homeroom teacher name labeled, (c) key for growth between assessment windows followed, (d) performance levels colored, and (e) aimswebPlus benchmark scores recorded in percentiles. Although the researcher-created instrument was found to have a moderately strong reliability, it could have been improved by (a) including the criteria on the rubric, not as a separate document, (b) having a total column for each assessment window, and (c) including a place to note the homeroom teacher's name.

Implications

The study has been deemed relevant to the field of education, specifically, student data tracking and academic achievement. According to Curtis (2017), assessments, grades, progress data, and goal setting should be used to not only guide teacher instruction, but to guide student

achievement. There should be a relationship between students' data tracking and the fidelity of student data tracking via data notebooks and their overall mathematical academic achievement.

With little to no studies focused on students' data tracking, this study serves as an addition to the empirical research currently available on the factors that affect student achievement (Curtis, 2017; Dishon-Berkovits, 2014; Hattie & Anderman, 2012; Marzano et al., 2014; Mitchell, 1982; Sasson, 2015). Since the present study found no statistically significant relationship between students' fidelity to data tracking and overall mathematical academic achievement, it may be inferred that the use of student data tracking does not have a direct relationship to students' academic achievement. The present study results were contradictory to the related literature and may have been a result of the newly implemented data tracking notebooks, lack of teacher and student training in how and why to use data tracking, or confusion and inconsistencies among classes. Wierda (2015) noted that the use of data tracking and a data notebook could lead to increased student achievement and could be a positive addition to a student-centered approach in classrooms. Hamilton et al. (2009) stated, "Data provide a way to assess what students are learning and the extent to which students are making progress toward goals. However, making sense of data requires concepts, theories, and interpretative frames of reference" (p. 5).

The use of assessments, grades, progress data, and data notebooks in an educational environment that fosters positive self-beliefs and optimism in one's own abilities and learning have been found to set the groundwork for achievement. Hamilton et al. (2009) provided recommendations of making data part of an ongoing cycle of instructional improvement by collecting and preparing a variety of data about student learning and teaching students to examine their own data and set learning goals. According to Newman (2012), goal setting has

been the first step, but not the last, in changing the way teaching and learning occurs for students to achieve success. He stated, "We also need to ensure the goals connect with our most important stakeholders—our students" (p. 13). Individual goals have been set by students where the students were involved in determining what they need to achieve personally to strive for success. Goal setting has been one of the most important and powerful strategies to make a school more successful by developing connections between all stakeholders, shaping the practice of shared leadership, and achieving academic results. This implication of the power of goal setting, if added to the use of the data notebooks, may have yielded a more statistically significant relationship between students' fidelity to data tracking via data notebooks and their overall academic achievement.

For many, setting individual student goals has been too time consuming. In fact, a lack of time has been found to be the most common reason given for not creating goals, not following through with goals once they are created, or not engaging and including students in the goal setting process. Although there has been time involved in the process, the time and dedication to focus on what is important to teach and learn is one of the most powerful tools for increasing student achievement. Newman (2012) supported this idea when he stated, "Goal setting is about setting priorities and zeroing in on teaching and learning priorities. When viewed in this vein, goal setting is actually a time-saving tool that helps place everyone in charge of their own learning" (p. 13). The process of reviewing student data, discussing an area where the student needs to improve, choosing strategies to help achieve the goal improvement area, and completing a goal sheet has been found to take the teacher and student about five minutes. However, these times have been more than made up because the student has "developed a clear path for success and is developing a level of ownership over his learning" (Newman, 2012, p. 15).

The data tracker used in the present study was designed for students to keep data records of their own learning and did not include a section for setting goals. The relationship between students' fidelity to data tracking and their overall academic achievement could possibly have been significant if the students not only tracked their learning data but set individual learning goals based on the data. Student-focused and mastery goals have been known to provide direction and focus for the teacher and student alike and have resulted in not only higher achievement but a stronger relationship between the use of data tracking via data notebooks and academic achievement.

Limitations

With all studies there are limitations, and an initial limitation for the present study was that it was a correlational design. According to Stangor (2011), "The goal of correlational research is to uncover variables that show systematic relationships with each other" (p. 16). In the present study, the researcher questioned if there was a statically significant relationship between fifth-grade students' fidelity to data tracking via data notebooks and their overall achievement in mathematics as measured by the aimswebPlus assessment. As Warner (2013) stated, "Correlation does not imply causation" (p. 265). This means that there was not a cause and effect relationship between the variables, and it could not be claimed that one variable caused the other.

The lack of correlation and presence of a curvilinear relationship does not allow the true strength and nature of the relationship to be revealed. As finding a correlation between two variables simply notes that a relationship exists, it was difficult to make accurate conclusions about the causes of the relationship. It was possible that neither of the variables caused the other and that some other variable caused the observed variables to be correlated (Stangor, 2011). As

noted by Gall et al. (2007), correlation coefficients are best used to measure the degree and direction of the relationship between variables and to explore possible causal factors: “Their causality can be tested more definitively by using an experimental research design” (p. 336).

Another limitation was that this test was limited to one middle school within one school district. Furthermore, the study was limited to students in the fifth-grade mathematics classes. Also, the researcher originally planned to use data from the current academic year of 2019–2020; however, due to COVID-19 and the closure of schools, there was not a spring aimswebPlus assessment administered. Therefore, the researcher chose to use archival data from the 2018–2019 school year. 2018–2019 was the first year the school implemented the use of data notebooks and student data tracking, which may have been a limitation as noted in the inconsistencies of the way teachers used the data trackers and possibly a lack of teacher training. Another limitation was one homeroom classroom within the study had an interim teacher. This teacher may not have received the same training on data notebooks, and the participants from that classroom may not have received the same data talks or emphasis on the data tracking notebooks as other participants. Lastly, the academic makeup of each homeroom class could present a limitation. Of the six homeroom classes, one was an honors level mathematics class, two were SPED inclusion mathematics classes, and the remaining three were general fifth-grade mathematics classes.

Recommendations for Future Research

The following are recommendations for future research.

(a) Conduct a follow-up study with a different sample of student participants. For example, select a different grade level sample, one with more experience in data notebooks.

(b) Conduct a follow-up study comparing the relationship of fidelity to data tracking and overall academic achievement across grade levels, comparing fifth, sixth, seventh, and eighth grades over one school year.

(c) Conduct a follow-up study with the same sample but over time. For example, the same sample of students during their sixth-, seventh-, and/or eighth-grade years.

(d) The researcher noted patterns in fidelity of data tracking rubric scores according to homeroom teachers. It is recommended that a study be conducted that examines the relationship between teacher fidelity, analyzing by each homeroom and cumulatively to the school-wide data notebook use and their students' overall academic achievement.

(e) The use of the aimswebPlus universal screener is just one instrument of student academic achievement used in the schools. It is recommended that a study be conducted that examines the relationship between tracking of learning data and academic achievement as measured by cumulative semester or yearly averages.

(f) The study examined only mathematics overall achievement. It is recommended that a study be conducted to examine overall academic achievement in the other content areas of English language arts, science, and social studies.

(g) The present study data could have been a result of first year implementation and a lack of training for teachers and students so they understand how to maintain and chart the learning data. It is recommended that a follow-up study be conducted after subsequent years of data tracking implementation and further training is provided to both teachers and students.

REFERENCES

Alcocer, P. (2019). History of standardized testing in the United States. *NEA- National Education Association.* Retrieved from http://www.nea.org/home/66139.htm

Ansell, S. (2011, July 7). Achievement gap. *Education Week.* Retrieved from https://www.edweek.org/ew/issues/achievement-gap/index.html

Armstrong, J., & Anthes, K. (2001). How data can help: Putting information to work to raise student achievement. *American School Board Journal, 88*(11), 38–41.

Baglici, S. P., Codding, R., & Tryon, G. (2010). Extending the research on the Tests of Early Numeracy: Longitudinal analyses over two school years. *Assessment for Effective Intervention, 35*(2), 89–102. https://doi.org/10.1177/1534508409346053

Bennett, R. E. (2011). Formative assessment: A critical review. *Assessment in Education: Principles, Policy, & Practice* 18(1), 5–25.

Berger, R., Rugen, L., & Woodfin, L. (2014). *Leaders of their own learning: Transforming schools through student-engaged assessment.* San Francisco, CA: Jossey-Bass.

Blankstein, A. (2004). *Failure is not an option: Six principles that guide achievement in high performing schools.* Retrieved from https://books.google.com/books

Bolam, R., McMahon, A., Stoll, L., Thomas, S., & Wallace, M. (2005). *Creating and sustaining professional learning communities* (Research Report No. 637). London, England: General Teaching Council for England, Department for Education and Skills.

Boopathiraj, C., & Chellamani, K. (2013). Analysis of test items on difficulty level and discrimination index in the test for research in education. *International Journal of Social Science & Interdisciplinary Research, 2*(2), 189–193.

Bray, B., & McClaskey, K. (2015). Learner voice and choice leads to engagement [Web log post]. Retrieved from http://www.centerdigitaled.com/blog/learner-voice-and-choiceleads-to-engagement.html

Burns, E. C., Martin, A., & Collie, R. J. (2018). Adaptability, personal best (PB) goal setting, and gains in students' academic outcomes: A longitudinal examination from a social cognitive perspective. *Contemporary Educational Psychology 53*, 57–72.

Busteed, J. (2013, January 7). The school cliff: Student engagement drops with each school year. Retrieved from https://news.gallup.com/opinion/gallup/170525/school-cliff-student-engagement-drops-school-year.aspx

Cao, L. & Nietfeld, J. L. (2007). Examining relationships between achievement goals, study strategies, and class performance in educational psychology. *Teaching Educational Psychology, 2*(1), 1–20.

Carey, T. & Carifio, J. (2012). The minimum grading controversy: Results of a quantitative study of seven years of grading data from an urban high school. *Educational Research, 41*(6), 201–208.

Center on Education Policy. (2012). *Can goals motivate students?* Washington, DC: The George Washington University Graduate School of Education and Human Development.

Chance, P., & Segura, S. (2009). A rural high school's collaborative approach to school improvement. *Journal of Research in Rural Education, 24*(5), 1–12.

Cheng, L., & Sun, Y. (2015). Teachers' grading decision making: Multiple influencing factors and methods. *Language Assessment Quarterly, 12*(2), 213–233.

Council of the Great City Schools. (2015, October). *Student testing in America's Great City Schools: An inventory and preliminary analysis.* Washington, DC: Council of the Great City Schools. Retrieved from https://www.cgcs.org/cms/lib/DC00001581/Centricity/Domain/27/Testing%20Report.pdf

Cousins, J. B., Goh, S. C., & Clark, S. (2006). Data use leads to data valuing: Evaluative inquiry for school decision making. *Leadership and Policy in Schools, 5,* 155–176.

Curtis, R.F. (2017). *Increasing engagement and motivation* (Doctoral dissertation, Carson Newman University). Retrieved from https://www.cn.edu/libraries/tiny_mce/tiny_mce/plugins/filemanager/files/Dissertations/Dissertations2017/Rebecca_Curtis.pdf

Cusumano, D. L. (2007). Is it working?: An overview of curriculum-based measurement and its uses for assessing instructional, intervention, or program effectiveness. *The Behavior Analyst Today, 8*(1), 24–34. http://dx.doi.org/10.1037/h0100099

Data Quality Campaign. (2015). *Data systems that work, empowering families and communities: What is student data?* Retrieved from dataqualtiycampaign.org

Dhillon, S., Darrow, C., & Meyers, C. V. (2015). Introduction to implementation fidelity. In C. V. Meyers and W. C. Brandt (Eds.), *Implementation fidelity in education research* (pp. 8–22). New York, NY: Routledge.

Dishon-Berkovits, M. (2014). A study of motivational influences on academic achievement. *Social Psychology of Education: An International Journal, 17*(2), 327–342.

DuFour, R. (2004). What is a "professional learning community?" *Educational Leadership, 61*(8), 6–11.

DuFour, R., DuFour, R., Eaker, R., & Many, T. (2010). *Learning by doing: a handbook for professional learning communities at work (second edition) action guide.* Retrieved from https://books.google.com/books

DuFour, R., & Eaker, R. (1998). *Professional learning communities at work: Best practices for enhancing student achievement*. Bloomington, IN: Solution Tree Press.

DuFour, R. P., & Marzano, R. J. (2011). *Leaders of learning: How district, school, and classroom leaders improve student achievement*. Bloomington, IN: Solution Tree.

Elikai, F., & Schuhmann, P. (2010). An examination of impact of grading policies on student achievement. *Issues in Accounting Education, 25*(4), 677–693.

Eppich, W. J., Hunt, E. A., Duval-Arnould, J. M, Siddal, V. J., & Cheng, A. (2015). Structuring feedback and debriefing to achieve mastery learning goals. *Academic Medicine 90*(11), 1501–1508.

Feldmann, G. (2012). *Early numeracy: technical adequacy of select kindergarten and first grade screening measures.* (Doctoral Dissertation, University of Iowa). Retrieved from http://ir.uiowa.edu/etd/2869

Fulton, K. (2012). Upside down and inside out: Flip your classroom to improve student learning. *Learning & Leading with Technology, 39*(8), 12–17.

Frey, N., & Fisher, D. (2011). *The formative assessment action plan: Practical steps for more effective teaching and learning.* Alexandria, VA: ASCD.

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research: An introduction*. Boston, MA: Allyn and Bacon.

Garrison, C., & Ehringhaus, M. (2007). Formative and summative assessments in the classroom. Retrieved from http://www.amle.org/Publications/WebExclusive/Assessment/tabid/1120/Default.aspx

Gawthrop, J. (2014). *Measuring student achievement: A study of standardized testing & its effect on student learning* (Doctoral dissertation, William Jessup University).

Gersten, R., Clarke, B., Jordan, N. C., Newman-Gonchar, R., Haymond, K., & Wilkins, C. (2012). Universal screening in mathematics for the primary grades: Beginnings of a research base. *Council for Exceptional Children, 78*(4), 423–445.

Graide Network (2018). *Grades vs learning - shifting attention to what's important*. Chicago, IL: The Chicago Literacy Alliance. Retrieved from https://www.thegraidenetwork.com/blog-all/2018/8/1/retiring-the-red-pen-shifting-attention-from-grades-to-learning/#gradesvslearning

Great Schools Partnership. (2013, August 29). Rubric. In *The glossary of education reform: For journalists, parents, and community members*. Retrieved from edglossary.org

Great Schools Partnership. (2019). Standardized test. *The glossary of education reform: For journalists, parents, and community members*. Retrieved from edglossary.org

Hamilton, L., Halverson, R., Jackson, S., Mandinach, E., Supovitz, J., & Wayman, J. (2009). *Using student achievement data to support instructional decision making* (NCEE 2009-4067). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. Retrieved from http://ies.ed.gov/ncee/wwc/publications/practiceguides/

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement.* New York, NY: Routledge.

Hattie, J., & Anderman, E. M. (2012). *International guide to student achievement.* New York, NY: Routledge.

Hoy, A., & Hoy, W. (2013). *Instructional leadership: A research-based guide to learning in schools.* Upper Saddle River, NJ: Pearson Education.

Isnawati, I., & Saukah, A. (2017). Teacher grading decision making. *Teflin Journal, 28*(2), 155–169. https:/doi.org/10.15639/teflinjournal.v28i2/155-169

Jeynes, W. H. (2015). A meta-analysis on the factors that best reduce the achievement gap. *Education and Urban Society, 47*(5), 523–554. https:/doi.org/10.1177/0013124514529155

Jordan, N. C., Kaplan, D., Oláh, L. N., & Locuniak, M. N. (2006). Number sense growth in kindergarten: A longitudinal investigation of children at risk for mathematics difficulties. *Child Development, 77*(1), 153–175.

grKellough, R. D., & Jarolimek, J. (2008). *Teaching and learning K–8: A guide to methods and resources* (9th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

Kiefer-Hipp, K., Bumpers-Huffman, J., Pankake, A. M., & Olivier, D. F. (2008). Sustaining professional learning communities: Case studies. *Journal of Educational Change, 9,* 173–195.

Kunnath, J.P. (2017). Teacher grading decisions: Influences, rationale, and practices. *American Secondary Education, 45*(3), 68–88.

Lachat, M. A., & Smith, S. (2005). Practices that support data use in urban high schools. *Journal of Education for Students Placed at Risk, 10*(3), 333–349.

Lascour, M., & Tissington, L. D. (2011). The effects of poverty on academic achievement. *Educational Research and Reviews, 6*(7).

Lawlor, K. B., & Hornyak, M. J. (2012). SMART goals: How the application of SMART goals can contribute to achievement of student learning outcomes. *Developments in Business Simulation and Experimental Learning, 39.* Retrieved from https://journals.tdl.org

Lembke, E., & Foegen, A. (2009). Identifying early numeracy indicators for kindergarten and first-grade students. *Learning Disabilities Research & Practice, 24*(1), 12–20.

Lembke, E., Foegen, A., Whittaker, T. A., & Hampton, D. (2008). Establishing technically adequate measures of progress in early numeracy. *Assessment for Effective Intervention, 33*(4), 206–214.

Lipton, L., & Wellman, B. (2012). *Got data? Now what? Creating and leading cultures of inquiry*. Bloomington, IN: Solution Tree.

Locke, E. A., & Latham, G. P. (2002). Building a practically useful theory of goal-setting and task motivation: A 35-year odyssey. *American Psychologist 57*(9), 705–717.

Marshall, K. (2017). Douglas Reeves takes on five myths about grading. *The International Educator.* Retrieved from https://www.tieonline.com/article/2126/

Martinez, R. S., Missall, K. N., Graney, S. B., Aricak, O. T., & Clarke, B. (2009). Technical adequacy of early numeracy curriculum-based measurement in kindergarten. *Assessment for Effective Intervention, 34*(2), 116–125. https://doi.org/10.1177/1534508408326204

Marzano, R. J. (2010). *Formative assessment and standards-based grading*. Bloomington, IN: Marzano Research Laboratory.

Marzano, R., Warrick, P., & Simms, J. (2014). *High reliability schools: The next step in school reform*. Bloomington, IN: Marzano Research Laboratory.

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370–96.

Maslow, A. H. (1954). *Motivation and personality*. New York, NY: Harper and Row.

Mathewson, T. G. (2017, February 6). These 7 trends are shaping personalized learning: Schools nationwide are experimenting with personalized learning strategies to better serve students. Education Drive. Retrieved from educationdrive.com

McLeod, S. (2020). Maslow's hierarchy of needs. *Simple Psychology.* Retrieved from https://www.simplypsychology.org/

McMillan, J. H. (2003). Understanding and improving teachers' classroom assessment decision making: Implications for theory and practice. *Educational Measurement Issues and Practice, 22*(4), 34–43.

Mendoza-Denton, R. (2014). A social psychological perspective on the achievement gap in standardized test performance between white and minority students: Implications for assessment. *The Journal of Negro Education, 83*(4), 465–484. https://doi.org/10.7709/jnegroeducation.83.4.0465

Methe, S. A., Begeny, J. C., & Leary, L. L. (2011). Development of conceptually focused early numeracy skill indicators. *Assessment for Effective Intervention, 36*(4), 230–242. https://doi.org/10.1177/1534508411414150

Mitchell, T.R. (1982). Motivation: New direction for theory and research. *Academy of Management Review, 7*(1), 80–88.

Moeller, A. K., Theiler, J. M., Wu, C. (2012). Goal setting and student achievement: A longitudinal study. *The Modern Language Journal, 96*(2), 153–169. https://doi.org/10.1111/j.1540-4781.2011.01231.x

Moss, C., & Brookhart, S. (2012). *Learning targets helping students aim for understanding in today's lesson*. Alexandria, VA: ASCD.

Munzur, Z. (2014). Reflections on the impact of absence of summative assessment on students' motivation and learning. *Journal of Education and Future, 6,* 72–89.

Mutlu, G., & Yildilim, A. (2019). Learning environment perceptions and student background of persistence in EFL learning. *Gulcin Mutlu Educational Sciences, 9*(4). https://doi.org/10.1177%2F2158244019898805

Newman, R. (2012). Goal-setting to achieve results. *Leadership, 41*(3), 12–16, 38.

Nitko, A. J., & Brookhart, S. M. (2011). *Educational assessment of students* (6th ed.). Boston, MA: Pearson.

No Child Left Behind Act of 2001, P.L. 107-110, 20 U.S.C. § 6319 (2002).

O'Hearn, E. (2013). *The relationship between the Boehm and AIMSweb on kindergarten student achievement in one northern Michigan intermediate school district* (Doctoral dissertation, Easter Michigan University).

Oxford Learner's Dictionaries. (n.d.). Persistence. In *Oxford Advanced Learner's Dictionary.* Retrieved from http://oald8.oxfordlearnersdictionaries.com/

Pearson (2018). AimswebPlus efficacy research report. Retrieved from https://www.pearson.com/content/dam/one-dot-com/one-dot-com/global/Files/efficacy-and-research/reports/efficacy-assessment-reports/aimsweb-Plus-research-report.pdf

Phillips, J. (2003). Powerful learning: Creating learning communities in urban school reform. *Journal of Curriculum and Supervision, 18*(3), 240–258.

Pipkin, C. (2015, May 20). How to prepare your students for student-centered learning [Web log post]. Retrieved from https://www.edsurge.com/news/2015-05-20-how-to-prepare-your-students-for-student-centered-learning

Popham, W. J. (2008). *Transformative assessment*. Alexandria, VA: Association for Supervision and Curriculum Development.

Prevo, G. (2014). The drive to improve: *A quantitative study of the relationship between professional learning communities and teacher motivation*. (Doctoral dissertation, University of Missouri). Retrieved from mospace.umsystem.edu/xmlui/handle/10355/44499

Reeve, J. (2015). *Understanding motivation and emotion* (6th ed.). Hoboken, NJ: Wiley.

Reeves, D. (2017, Spring). Busting myths about grading. *All Things PLC.* Retrieved from https://issuu.com

Reeves, D. (2019). Top five tips for effective data teams. AASA: The School Superintendents Association. Retrieved from aasa.org

Rigoglioso, M. (2013). Simple interventions to bridge the achievement gap between Latino and White students, Stanford researcher finds. Stanford Business. Retrieved from gsb.stanford.edu

Rowe, D. A., Mazzotti, V. L., Ingram, A. (2016). Effects of goal-setting instruction in academic engagement for students at risk. *Career Development and Transition for Exceptional Individuals, 40*(1), 25–35.

Rukavina, S., Zuvic-Butorac, M., Ledic, J., Milotic, B., & Jurdana-Sepic, R. (2012). Developing positive attitude towards science and mathematics through motivational classroom experiences. *Science Educational International*, *23*(1), 6–19.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Education Psychology, 25*, 54–67. doi:10.1006/ceps.1999.1020

Sander, L. & Sanders, P. (2009). Measuring academic behavioral confidence: The ABC scale revisited. *Studies in Higher Education 34*(1), 1935.

Sasson, D. (2015). Effective goal setting for students. Retrieved from http://teaching.monster.com/benefits/articles/9440-effective-goal-setting-for-students

Schunk, D. H. (1990). Goal setting and self-efficacy during self-regulated learning. *Educational Psychologist,* 25, 71–86.

Schunk, D. H. (2016). *Learning theories: An educational perspective* (7th ed.). Upper Saddle River, NJ: Pearson.

Semega, J., Kollar, M., Creamer, J., & Mohanty, A. (2019). *Income and poverty in the United States: 2018* (Report No. P60-266). Washington, DC: United States Census Bureau. Retrieved from https://www.census.gov/library/publications/2019/demo/p60-266.html

Souders, B. (2019). What is motivation? A psychologist explains. Retrieved from http://positive psychology.com

Stangor, C. (2011). *Research methods for the behavioral sciences*. Boston: Houghton Mifflin Company.

Stankov, L., Morony, S., & Ping Lee, Y. (2014) Confidence: The best non-cognitive predictor of academic achievement? *Educational Psychology, 34*(1), 9–28. doi:10.1080/01443410.2013.814194

Thompson, J. & Grabau, L. (2004). A la carte grading: Providing students opportunities to determine their own paths to success. *Journal of Natural Resources and Life Sciences Education, 33,* 92–97.

Tierney, R. D. (2015). Altered grades: A grey zone in the ethics of classroom assessment. *Assessment Matters 8*(Special Issue), 5–30.

Turner, H. (2018). What is universal screening? Definitions & tools. Retrieved from https://study.com/academy/subj/social-science.html

U.S. Department of Education. (2006). *No child left behind: Highly qualified teachers for every child.* Retrieved from https://www2.ed.gov/nclb/methods/teachers/stateplanfacts.html

U.S. Department of Education. (2009). *Race to the top program: Executive summary.* Retrieved from http://www.2.ed.gov/programs/racetothetop

Vescio, V., Ross, D., & Adams, A. (2008). A review of research on the impact of professional learning communities on teaching practice and student learning. *Teaching and Learning, 24*, 80–91.

Waldman, C. (2015). Testing overload?: New study finds U.S. students are spending time taking redundant tests. *Alliance for Excellent Education, 15*(20).

Walters, S. R., Silva, P., & Nikolai, J. (2017). Teaching, learning, and assessment: Insights into students' motivation to learn. *The Qualitative Report 22*(4), 1151–1168.

Warner, R. M. (2013). *Applied statistics* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Warrick, P. B. (2018, June 25). High reliability schools and PLCs [Web log post]. Retrieved from https://soultiontree.com

Weick, K. E., & Sutcliffe, K. M. (2007). *Managing the unexpected: Resilient performance in an age of uncertainty*. San Francisco, CA: Jossey-Bass.

Wesson, C., & Derrer-Rendall, N. M. (2011). Self-beliefs and student goal achievement. *Psychology Teaching Review, 17*(1), 3–12.

Wierda, B. (2015, August 15). Using student data as a tool in self-directed learning [Web log post]. Retrieved from leaderinme.org

York, E. A. (2010). *Meaningful measurement: Is fluency a valid and reliable measure of reading progress for struggling adolescent readers? Examining the efficacy of Pearson's AIMSweb for struggling adolescent readers* (Master's thesis, University of New Hampshire, Durham). Retrieved from: https://scholars.unh.edu/thesis/185

Zimmerman, B., Bonner, S., & Kovach, R. (1996). *Developing self-regulated learners: Beyond achievement to self-efficacy*. Washington, DC: American Psychological Association. Retrieved from http://psycnet.apa.org/books/10213/

APPENDICES

Appendix A: Research Approval – District

[REDACTED]

Appendix B: Research Approval – Building Principal

[REDACTED]

Appendix C: Research Rubric Tool for Fidelity of Data Tracker

RUBRIC for DATA TRACKER

RUBRIC KEY

5	4	3	2	1
Optimal 5 expectations met	**Above Average** 4 expectations met	**Average** 3 expectations met	**Needs Improvement** 2 expectations met	**Below Average** 0-1 expectations met

RUBRIC for: _____

	Student Name	Grade & HR	Key Followed	Performance Level Color	AIMSWEB Scores %ile	Total Score
FALL						
WINTER						
SPRING						

NOTES:

SCORED BY:

DATE:

Appendix D: Example of Participant Data Tracker Form

Tenacious Tiger Tracker

Middle School 2018-2019 School Year

Name:_____ Grade:____ Teacher:_____

KEY

⇧		Positive Growth
=		Neutral
⇩		Negative Growth

PERFROMANCE LEVEL

Mastery		Blue
On Track		Green
Approaching		Yellow
Needs Support		Red

Report Card Grades

	Q1	Q2	Q3	Q4
ELA	95	95	75	
MATH	B	97	95	
SCI	91	94	93	
SS	89	96	99	

Quarter Exam Grades

	Q1	Q2	Q3	Q4
ELA	75	85	75	
MATH	93	97	85	
SCI	89	94	93	
SS	88	84	93	

AIMSWeb Benchmark Scores

	SPRING 2018	FALL 2018	WINTER 2019	SPRING 2019
READB	24	38 ↑	44 ↑	
MATHB	32	52 ↑	45 ↓	
Lexile	195L	—	940	—