A Study on Student Science Achievement as Measured by a Standardized Test of the effect of Traditional and Standards-Based Grading Practices

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ABSTRACT

This study was conducted to first determine if a relationship exists between academic grades and achievement on standardized state science assessments. Secondly, the study was conducted to determine if there is a statistically significant difference between standards-based and traditional grading practices and student success on standardized tests. The study used correlation, paired *t*-tests, and Chi-Square to determine if schools that use standards-based grading practices have greater student success on state testing than schools that use traditional grading practices. The findings show there is a relationship between teacher assigned grades and standardized test scores. There is no statistically significant difference between teacher-assigned grades and achievement levels on standardized state tests when standards-based grading practices are used. There is however, a statistically significant difference between teacher-assigned grades and achievement levels on standardized state tests when traditional grading practices are used. There is a statistically significant difference between student success on the 8th grade science MAP when students are enrolled in schools that fully implement standards-based grading practices and schools that use traditional grading practices. Standards-based grading practices have a positive impact on students and districts should consider examining current grading practices to further improve student achievement.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

CHAPTER ONE
INTRODUCTION TO THE STUDY

Background

In education today, student achievement and high stakes summative assessments play a major role in how a school's success is perceived. Grading has been around for a long time, but educators still search for a formula that consistently gauges student achievement within a single mark. Marzano (2010) states,

> Not only are teachers responsible for evaluating a student's level of knowledge or skill at one point in time through classroom assessments, they are also responsible for translating all of the information from assessments into an overall evaluation of a student's performance over some fixed period of time (usually a quarter, trimester or semester). (p.15)

In a search to find a practice that offers a more accurate reflection of student learning, standards-based grading practices continue to become more widely used in educational settings.

Traditional forms of grading such as Norm-Referenced Grading, Criterion-Referenced Grading and Self-Referenced grading all produce a mark such as the one that Marzano speaks about and are still used in forms of traditional grading. Each of these practices fall short in measuring and representing the achievement level of a student according to Marzano (2010). In traditional grading practices, an average is created between 0% and 100% to represent where a student falls between an A letter grade and a F. Typically, in traditional grading practices, all assignments are averaged into an overall grade along with pre and post assessments with behaviors such as missing work heavily influencing a student's academic mark.

In a standards-based grading approach, the behaviors such as late homework, missing homework, being polite or having behavior problems are removed from the academic grade making the academic mark a reflection of the true academic level of a student. Standards-based grades are typically reported as Advanced, Proficient, Basic and Below Basic with behaviors reported in a separate mark. In traditional grading, grades are typically populated around an average of all assignments while standards-based grading is focused on specific learning standards and a student's specific mastery of those identified standards.

When looking at overall student achievement, it is important to remember that in Missouri students are assessed on the Missouri Learning Standards, or "the knowledge and skills students need in each grade level and course for success in college, other post-secondary training and careers. These grade-level and course-level expectations are aligned to the Show-Me Standards" (About the Missouri Learning Standards, n.d, http://www.missourilearningstandards.com/about/). These standards are the same standards that teachers and students are held accountable for on the end of the year EOC (End of Course Exam) and GL MAP (Grade Level Map Exam) in Missouri. Although some might argue the score on a state exam is one test, it is a test by which schools are measured.

This study will analyze the difference between academic grades and end of the year/course state assessments in Science in grades 5 and 8 and in Biology I. The study will further research to see if the grades produced in a school with full implementation of standards-based grading practices have greater student success on state testing than schools that use traditional grading practice.

Conceptual Underpinning

The first lens used examines standardized testing in Missouri, specifically the EOC (End of Course) and the GL MAP(Grade Level Missouri Assessment Program) exams. The state of Missouri annually analyzes the performance of students on both the EOC and GL MAP during its MSIP 5 process. The review of the state assessment data is part of Missouri's accreditation review process in which they examine each district in Missouri's APR results over the last three years (Accreditation Classification of School Districts, n.d, https://dese.mo.gov/quality-schools/mo-school-improvement-program/accreditation-classification-school-districts). Although there are more pieces to the state accountability program than testing, the MSIP review process lies heavily on state assessments to make decisions about a school's accreditation.

The second lens used is traditional-grading practices in which grades are created in relation to percentage between 0-100% and are represented with a letter grade of A,B,C,D or F. Traditional grading practices are any practice that uses the traditional system above and in some way includes the behavior element within the academic mark. The majority of educators use a traditional grading practice. Marzano (2010) states that "Since teachers in many schools and districts have not agreed on any one grading philosophy, they are forced to design their own system." The issue with traditional grading practices are the lack of accuracy that the grade has when representing solely student achievement.

The final lens used by the researchers is standards-based grading, or a grading practice which takes behaviors out of a grade, allowing the academic mark of Advanced, Proficient, Basic or Below Basic to represent solely a student's achievement on standards within the course. Many schools continue to search for a more accurate representation of student achievement, and standards-based grading, or grading that is a reflection of where students fall on specific

standards are becoming very popular according to Marzano (2010). Studies have been completed and little research exists to support that students in a standards-based grading system achieve at a higher level than those students in a traditional grading system. Researchers such as O'Connor (2002), Marzano (2010), Dueck (2014) and Schimmer (2016) do suggest that by removing the non-academic contributors from a grade that it can make it much more accurate.

In this study, researchers will continue to investigate teacher-assigned academic grades and their correlation to state GL MAP tests and EOC tests in schools utilizing standards-based grading practices and schools that use traditional grading practices. The further investigation will allow the researchers to see if grades produced in standards-based grading are more accurate at predicting achievement levels on state assessments.

Statement of Problem

There is a lack of information related to teacher-assigned grades and student performance on state level science assessments. More formally, there in not specific evidence that links implementation of building-wide grading practices to student performance on standardized state science assessments. In Missouri, like other states, many school districts have formally changed grading practices, but there is lack of information about how these changes have directly impacted teacher-assigned grades and the connection to state test scores.

Purpose of the Study

The researchers' purpose of this study is to fill in the gaps in knowledge between implementation of standards-based grading practices and actual student performance in the classroom and on standardized state science assessments at various grade levels. To do this, researchers sought to determine if a relationship exists between teacher-assigned grades in elementary, middle and high school science classes and state science MAP scores and EOC

biology performance. Furthermore, the study seeks to identify if a statistically significant difference exists between classroom grades and state science test scores for schools that have formal standards-based grading practices and policies as compared to schools without formal practices and policies.

Research Questions

The researchers were interested if there was a difference between teacher-assigned grades and standardized test scores in buildings that have a full implementation of standards-based grading compared to buildings that did not have a specific grading practices implemented building wide. To investigate the difference between grading practices, the researchers developed seven specific research questions listed below.

- RQ1: Is there a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 5th grade?
- $H_0$1: There is no relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 5th grade.
- RQ2: Is there a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 8th grade?
- $H_0$2: There is no relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 8th grade.
- RQ3: Is there a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in biology?
- $H_0$3: There is no relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in biology.

- RQ4: Is there a difference in teacher-assigned grades produced using traditional grading practices and grades produced using standards-based grading practices?
- $H_0$4: There is no significant difference in teacher-assigned grades produced using traditional grading practices and grades produced using standards-based grading practices.
- RQ5: Is there a difference in teacher-assigned grades produced using standards-based grading practices and student achievement levels on the 8th grade science MAP?
- $H_0$5: There is no significant difference in teacher-assigned grades produced using standards-based grading practices and student achievement levels on the 8th grade science MAP.
- RQ6: Is there a difference in teacher-assigned grades produced using traditional grading practices and student achievement levels on the 8th grade science MAP?
- $H_0$6: There is no significant difference in teacher-assigned grades produced using traditional grading practices and student achievement levels on the 8th grade science MAP.
- RQ7: Are students enrolled in schools that use standards-based grading practices more successful on the 8th grade science MAP than students enrolled in schools that use traditional grading practices?
- $H_0$7: There is no significant difference in student success on the 8th grade MAP between students enrolled in schools that use standards-based grading practices and students enrolled in schools that use traditional grading practices?

Anticipated Benefits of the Study

Several benefits are anticipated from this study. One, the study will determine if there is a statistically significant difference in standardized test scores when comparing schools using standards-based practices and schools using traditional grading practices. Building level teachers and administrators may benefit from the data by using it to reflect on current grading practices. If a difference exists between grading practices and test scores, steps should be taken to improve grading practices. The data can be a valuable source of evidence to justify the need for continued professional development related to grading practices. Secondly, recognition of the connection between grades determined using standards-based practices and state test scores would encourage data teams to work to implement additional differentiation strategies to help improve student's conceptual understanding of science concepts. Finally, if the study shows a statistically significant difference between schools that have formal standards-based grading practices and the state test scores, researches can propose creation of district level standards-based grading practices. Creation of a district-wide policy can exponentially impact student success.

Limitations of the Study

The study has several limitations. The group of students selected for this study are from one school district in northwest Missouri and may not be representative of other districts with similar demographics. Due to the need of paired data, students in the study had to attend schools within the district from at least fifth to eleventh grade which limited the number of eligible students in the study. Student science grades for second semester and/or year average were used, but no other subject level data was considered. The district described in this study has no formal grading policies and a formal survey was not conducted to see if teachers share similar practices.

The researchers assume teachers in most buildings use “traditional grading practices” to determine semester and year-end grades.

Delimitations of the Study

The defined limits for this study include that students had to attend grades 5-11 in the selected district and had to have completed state science MAP tests in 5th grade and 8th grade as well as the high school Biology EOC. Each student had to be assigned to regular education classes and could not be in self-contained science classrooms. The current 11th grade classes from two of the area high schools were considered for the study, while students who attended the third area high school was excluded from the study. The teacher-assigned grade data that the researchers used was pulled from Powerschool for analysis. Within the district, elementary grades are stored quarterly where secondary grades are stored per semester. When accessing the data, the researchers were only able to access a year-end average grade for elementary students and were only able to access stored grades by semester for middle and high school grades. Middle and high school grades from second semester were used for comparison, while elementary year average was examined. Second semester grades were selected since they are produced in the spring which is closer to the window to administer state MAP and EOC tests. Demographic data related to free and reduced lunch, IEP, and other health issues were not considered in this study.

Definition of Terms

Standards-Based Grading: Marzano (2010) defines standards-based grading as grading that looks at certain topic areas within a subject, but then when assigning a grade uses the practice of placing students in a performance category.

Traditional grading: A grading scale where letter grades are used to represent student learning as well of a percentage from 0 to 100%.

Missouri Assessment Program (MAP): Standardized assessments for English, Mathematics and Science for grades 3-8 to check student progress towards mastery of the Show-Me Standards

End of Course Exam (EOC): An exam taken at the end of a course that assesses progress toward the Missouri Learning Standards.

Missouri Department of Elementary and Secondary Education (MODESE): An educational agency for the state of Missouri.

Below Basic, Basic, Proficient, Advanced: Instead of an A,B,C,D or F, these are words that are assigned to achievement levels for grading. Below Basic has an achievement level score of 1, Basic has an achievement level score of 2, Proficient has an achievement level score of 3 and Advanced has an achievement level score of 4.

Achievement Level: Descriptors used to report student performance on the state assessment based on a range of scale scores. (Sample: Advanced 225-250, Proficient 200-224, Basic 178-199, Below Basic 100-177) The scale scores for each level are determined by a group of educators, post-secondary educators and community business members.

MOSIS Identification: A unique identification number given to every student receiving educational service in Missouri public school so information collected at the individual student level.

Summary

A study was conducted to determine if there is a significant difference between teacher-assigned standards-based grades and state tests and teacher-assigned traditional grades and standardized state tests in the area of science. In the study, the researchers were looking to see the difference between high schools assigned grades and biology EOC student achievement levels, middle school assigned grades and MAP achievement levels and finally elementary assigned grades and MAP achievement levels of the same group of students. Then, the researchers were specifically looking to determine if there is a statistically significant difference between grades and test scores in schools that fully implement standards-based grading practices and schools that use traditional grading practices. When this study is complete, this study could provide the opportunity for further research on a larger scale and across multiple content areas. After further study, the data from this research could be used to promote standards-based practices across a district to improve the accuracy of teacher-assigned grades.

CHAPTER TWO
REVIEW OF LITERATURE

Overview

In this chapter, the researchers will analyze and discuss three pillars of literature looking at grading practices and end of the year test scores. Specifically, traditional grading and its accuracy of representing student achievement, a standards-based grading overview and its accuracy of reflecting student achievement and standardized tests and their relationship to teacher-assigned grades. The sections within this chapter will include standardized testing, Missouri standardized tests, student achievement levels on the GL MAP test in science, student achievement levels on the biology EOC exam, accountability to standardized tests, related studies involving standardized testing, reasons for grades, characteristics of traditional-based grading, related studies involving traditional-based grading, characteristics of standards-based grading and related studies involving standards-based grading. The researchers used each of these pillars as information to help make conclusions and analyze their study.

Standardized testing

"Standardized testing can be defined as any form of test that (1) requires all test takers to answer the same questions, or a selection of questions from common bank of questions, in the same way, and that (2) is scored in a "standard" or consistent manner, which makes it possible to compare the relative performance of individual students or groups of students" (Standardized Test Definition, 2014, http://edglossary.org/standardized-test/). These tests are often used in states to make conclusions about students and their understanding of course or grade-level learning standards. According to individuals such as Popham (1999), standardized tests were designed to give schools and parents feedback and comparison data, but do not completely

represent the success of a school's performance due to the influence of too many other attributes. Popham (1999) stated that experiences that students have outside of school is one of the major attributes. Unfortunately, contrary to many negative opinions on standardized tests, schools are held accountable in this area by the state.

Missouri Standardized Tests

The researchers of this study specifically looked at information from Missouri state assessments. The MAP(Missouri Assessment Program) includes both the GL MAP test and the EOC exam and begins at the end of the 3rd grade year and continues until grade 12. Both tests are designed to measure progress toward skills or content identified in the Missouri Learning Standards. Specifically, the Missouri Learning Standards are defined as the knowledge and/or skills that are deemed necessary for students to be successful in school and after graduation and are designed to give educators direction when teaching students (About the Missouri Learning Standard, n.d., http://www.missourilearningstandards.com/about/). Through these assessments, school staff members are able to break down data to the individual student level, but are also able to look at student comparisons across districts. These comparisons allow for the discovery of any issues of implementation of the MLS(Missouri Learning Standards) and to look at the overall performance of the school compared to others in the state.

The GL MAP test is given in the areas of english language arts, mathematics and science in grades 3-8 prior to high school. Although english language arts and mathematics are tested all years starting in 3rd grade and ending in 8th grade, science is only tested at the conclusion of the 5th grade year and 8th grade year. The science MAP is a grade span test that assesses student understanding of three years of standards. In high school, grades 9-12, the GL MAP test is no longer given, but an EOC(End of Course) exam is given at the completion of English I, English

II, Algebra I, Algebra II, Geometry, U.S. History, Government, Biology I and Personal Finance (MAP information for parents, n.d, https://dese.mo.gov/map-information-parents).

Student achievement levels on the GL MAP test in Science

Students on the GL MAP test receive both a scale score and an achievement level score. The state vendor, Data Recognition Corporation, uses the scores from students to compute a scale score which is then assigned an achievement level (Missouri Assessment Program Grade Level Assessments: Guide to Interpreting Results, 2016, p.3). The scale scores for each level are determined by a group of educators, post-secondary educators and community business members. Specific descriptors from the MAP GL Assessments: Interpreting Results (2016) manual of each achievement level for students in grade 5 are reported in Table 1. The table shows a breakdown of Advanced, Proficient, Basic and Below Basic as it specifically relates to science in grade 5.

Table 1
Missouri GL MAP Achievement-Level Descriptors for Science Grade 5

Advanced	Students identify energy transformations; predict the effect of heat energy on water; diagram a complete electrical circuit; predict how simple machines affect the force needed to do work; describe the effects of weathering and erosion on Earth's surface; describe relationships in weather data; explain how the Sun's position and the length and position of shadows relate to the time of day; interpret and apply knowledge from a data table; identify appropriate steps and tools in an investigation. MAP score range: 692–855
Proficient	Students describe changes in properties of matter; identify uses of simple machines; explain how work is done; identify forces of magnetism; describe the motion of objects; identify plant parts and their functions; classify vertebrates and invertebrates; classify producers, consumers, or decomposers; predict changes in food chains; identify the effects of human activities on other organisms; describe the Sun as a source of light and heat, or the moon as a reflector of light; explain the day/night cycle; interpret data; distinguish between man-made and natural objects; apply problem solving skills to a situation. MAP score range: 669–691
Basic	Students explain the relationship between mass and force; describe how specialized body structures help animals survive; match environments to the plants and animals they support; identify environmental problems and find solutions; determine the appropriate scientific tool and its function in an investigation; determine how technological advances address problems and enhance life. MAP score range: 626–668
Below Basic	Students identify the relationship between mass and force; classify bodies of water; identify weather instruments and their uses; identify characteristics of the solar system; compare amounts/measurements given in a simple format; identify appropriate tools for simple scientific measurements; identify how technological advances may be helpful to humans. MAP score range: 470–625

Note: Missouri Assessment Program Grade-Level Assessments: Guide…(2016, pg. 13)

The MAP GL Assessments: Interpreting Results (2016) manual, shows the same break down of achievement levels, except this time the descriptors are for the proficiency levels of Advanced, Proficient, Basic and Below Basic for science students in grade 8 are reported in Table 2.

Table 2. Missouri GL MAP Achievement-Level Descriptors for Science Grade 8

Advanced	Students explain the physical and chemical properties of matter; apply knowledge of energy and energy transfer; demonstrate understanding of physical and chemical processes of organisms; evaluate the effects of balanced and unbalanced forces; predict the impact of environmental change in ecosystems; justify how adaptations help organisms survive; demonstrate understanding of the water cycle; compare and contrast weather and climate; explain the cause of seasons on Earth; demonstrate understanding of the solar system; apply the concept of light years; apply awareness of the influence of science and technology in society. MAP score range: 735–895
Proficient	Students classify types of motion; calculate the speed of an object; demonstrate simple understanding of life processes; classify and/or show relationships between organisms; explain how adaptations help organisms survive; explain how species are affected by environmental change; understand and describe a food web; explain rock and fossil evidence of changes in the Earth; explain how Earth's systems interact; draw conclusions from tables or graphs; demonstrate basic understanding of the solar system; recognize the need for, and calculate, averages; use appropriate tools and methods to collect data; describe tools and discoveries that advance scientific knowledge. MAP score range: 703–734
Basic	Students identify an example of a force; demonstrate simple understanding of how traits are passed from one generation to the next; have a basic understanding of climate; identify a simple hypothesis; recognize a trend in a data table; demonstrate some awareness of how various factors influence and are influenced by science and technology. MAP score range: 671–702
Below Basic	Students identify simple terms related to matter and energy; demonstrate beginning understanding of properties of light and how it travels; identify structures of plants and animals needed for survival; identify levels of organization in multicellular organisms; read simple graphs and make simple data comparisons. MAP score range: 540–670

Note: Missouri Assessment Program Grade-Level Assessments: Guide…(2016, pg. 13)

Student achievement levels on the Biology EOC exam

Students that are assessed on the EOC (End of Course) exam receive both a scale score and an achievement level. On the biology EOC (End of Course) exam, the scale score is determined by the EOC testing vendor, Questar, and scale scores are assigned from 100 to 250 points based upon the correct responses of the student (Online End-of-Course Assessments Guide to Interpreting Results Spring 2016, 2016, https://dese.mo.gov/sites/default/files/asmt-gl-gir-spring- 2016.pdf).

The student achievement level on the biology EOC is determined from the student's scale score. Each achievement level describes the level of understanding that a student has in biology based on the scale score on the EOC exam. Specific descriptors of each of the specific achievement levels that define the students for the biology EOC retrieved from the MODESE Online EOC Assessments Guide to Interpreting Results Spring 2016 manual are organized in Table 3. These descriptors define what the terms Advanced, Proficient, Basic and Below Basic represented as an achievement level. The actual scale score ranges that make up each proficiency level are determined by a group of educators, post-secondary faculty workers and business members in the community as an attempt to compare standardized test scores with academic achievement according to the Online EOC Assessment Guide to Interpreting Results for 2016.

Table 3.
Missouri Biology EOC Achievement-Level Descriptors

Advanced	Students performing at the Advanced level on the Missouri End-of-Course Assessment demonstrate a thorough understanding of the Course-Level Expectations for Biology. They demonstrate these skills in addition to understanding and applying the skills at the Proficient level; students scoring at the Advanced level use a range of strategies. Scale Score: 225–250
Proficient	Students performing at the Proficient level on the Missouri End-of-Course Assessment demonstrate an understanding of the Course-Level Expectations for Biology. They demonstrate these skills in addition to understanding and applying the skills at the Basic level; students scoring at the Proficient level use a range of strategies. Scale Score: 200–224
Basic	Basic: Students performing at the Basic level on the Missouri End-of-Course Assessment demonstrate a partial understanding of the Course-Level Expectations for Biology. They demonstrate these skills in addition to understanding and applying the skills at the Below Basic level; students scoring at the Basic level use some strategies. Scale Score: 177–199
Below Basic	Students performing at the Below Basic level on the Missouri End-of-Course Assessment demonstrate a limited understanding of the Course-Level Expectations for Biology. In addition to demonstrating these skills, students scoring at the Below Basic level use very few strategies and demonstrate a limited understanding of important Biological content and concepts. Scale Score: 100–176

Note: Online End-of-Course Assessments Guide to Interpreting (2016, pg. 11)

Accountability to Standardized Tests

In Missouri, standardized tests are a piece of the evaluation puzzle when deciding the overall effectiveness of a school at the conclusion of a school year. Specifically, in Missouri, districts are held accountable by the MSIP 5 review process. MSIP stands for "Missouri School Improvement Program" and its goal is to examine districts overall and to decide an overall performance that is as accurate as it can be (MSIP 5 Questions and Answers, n.d, https://dese.mo.gov/sites/default/files/msip5-faq.pdf). Then, the Missouri Department of

Education uses this information to identify areas of growth for buildings and districts and to recognize high performing buildings and districts. The overall performance of a building or district is evaluated by MSIP 5 to help ensure that students are graduating career or college ready (MSIP 5, n.d, para. 3).

The overall score for a building or district is calculated by examining five different standards identified by MSIP 5 as well as examining areas in the building or district such as status, progress and growth. The five areas used to determine an accreditation level for a district are, academic achievement, subgroup achievement, high school readiness or college and career readiness, attendance rate and graduation rate (Comprehensive Guide to the Missouri School Improvement Plan, 2016, https://dese.mo.gov/sites/default/files/MSIP_5_2016_Comprehensive_Guide.pdf). According to the Comprehensive Guide to the Missouri SIP (2016), MSIP 5 focuses mainly on the following areas when evaluating schools in relation to academic achievement:

- Student performance on assessments and if the performance meets the state standard and/or shows growth.
- The percentage of students tested on each required MAP assessment and if the percentage meets the state standard.
- Students meeting or exceeding growth expectations.

Related studies involving standardized testing

Although some studies exist in the area of standardized testing, few studies exist that look at grading practices and their accuracy as they relate to standardized test scores. A recent study by Lloyd (2016) looked at schools that were considered exemplary on state test scores and collected observational data to explore possible reasons that the scores were occurring. Through

her study, Hoskins Lloyd (2016) concluded and stated that "Standardized test scores have served as a single predictor of teacher effectiveness and provide stakeholders with quantitative data to measure students' academic achievement and growth." The study really examined how teachers were producing exemplary standardized test scores by examining their practices within the classroom. After observing teachers with exemplary standardized test scores, Hoskins Lloyd (2016) concluded that the majority of the teachers observed had the following traits within their teaching:

- Reinforcement
- Higher-order questioning
- Connection to previous learning and other content areas
- Development of a community of respectfulness
- Emphasis on academic language
- Encouragement of classroom dialogue
- Students' demonstration of self-efficacy
- Motivation
- Focus
- Engagement and independence
- The presence of a print rich environment

Although this study did not specifically relate grading and specific test scores, it did examine teacher practices and stated that some items strongly related to grading such as self efficacy, reinforcement and motivation were present in teachers' rooms who produced higher test scores.

Another study by Ussery (2014), looked at grades assigned by teachers in a junior high math class and the correlation between the the MAP test following. Through her study, Ussery

(2014) did find that there was a correlation between the teacher-assigned grades and the Math MAP test given at the end of the year, rejecting the null hypotheses of "There is no relationship between mathematics class grades and MAP scores." Within this study, the practice under examination was specifically traditional-based grading and MAP scores. Ussery (2014) does note that traditional grading did have have a relationship to MAP test scores but also noted that the study was flawed in some ways. Ussery (2014) also concluded that by doing this study again in multiple classrooms might yield different results and stated that much data completed recently shows a need for change in grading processes.

Traditional-Based grading

Reasons for grades

Many educators in education still debate about how to assign academic marks for students, but the majority agree that grades need to be accurate reflections of student learning. Marzano (2010) states that teachers are responsible for condensing all of the information they have about a student into one overall performance mark over a period of time. The issue with condensing all of the information about a student is ensuring that the grade is accurate. O'Connor (2002) makes a case for accurate grading marks and states that communication of where a student is academically is the primary focus of a grade. O'Connor (2002) goes on to state that if the mark is not accurate, that no other purpose of a grade can be carried out. Tom Schimmer (2016) continues to build on prior studies in grading and has produced a theory of "True North" which states that when assigning a grade the most important attributes are accuracy and the grades ability to help in sustaining or growing student confidence. Researchers in the area of assessment have a common theme in their studies and argue that the reason for a grade is to accurately report student achievement.

Characteristics of traditional grading

Traditional-based grading can mean a lot of things in education. Holfebower and Marzano (2011) define it by stating

> "In the traditional system, students acquire points for various activities, assignments, and behaviors, which accrue throughout a grading period. The teacher adds up the points and assigns a letter grade. A variation on this theme is to keep track of percentage scores across various categories of performance and behavior and then translate the average percentage score into a letter grade or simply report the average percentage score (for example, 62.9 percent)" (p.34).

Marzano (2010) calls this letter grade assigned in a traditional grading system an "omnibus grade" which is an attempt to give an overall conclusion of learning for a time period.

As stated by O'Connor (2002), grading systems that report grades using a letter grade of A,B,C,D,F or a number system are most common. Most use percentages to represent the overall grade of a student in correlation to a letter grade: A (90-100%), B (80-89%), C (70-79%), D(60-69%) and an F (59% and below) according to O'Connor (2002). Many districts even add a plus or minus to the letter grade to indicate if a student is closer to top of the range of the letter grade or closer to the bottom. This percentage, according to O'Connor (2002), typically tends to include everything that is scored on a student. Marzano (2010) further argues that traditional grading doesn't identify the difference between "practice" and homework because everything in traditional grading is counted. Marzano talks of practice and is referring to work that is not counted toward a final grade but is simply an opportunity to practice a skill without being penalized.

Grade averaging also is a common practice that is accepted by most in the educational system. It has been a practice for a long time and is defined as "the practice of calculating semester, end-of-term, or end-of-year course grades by taking the sum of all numerical grades awarded in a course and then dividing that sum by the total number of grades awarded" (Grade Averaging, 2013, http://edglossary.org/grade-averaging/). Some argue that this system of averaging grades teaches responsibility for students and holds them accountable, while others such as Marzano (2010) believe that if a grade isn't a true reflection of a student's learning that it loses meaning. Averaging grades in a traditional grading system also allows for a grade to represent more than student academic achievement. Marzano (2010) suggests that our traditional practices focus too much on grading practice work and not enough on the actual growth of a student. In a traditional-based grading practice where averages are used to calculate grades, a student behavior of not turning in an assignment or multiple assignments could misrepresent or inaccurately represent a student's cognitive ability.

Behaviors such as missing or late work can highly impact a student's academic grade in a traditional-grading system. A student could receive 100% on one assignment, and a 0% on the next assignment because they did not turn in the assignment. When these two assignments are averaged together, the student would receive a 50%, which is an F in a traditional-grading practices. The grade that is designed to report academic achievement for a student is not an accurate representation of academic achievement when behaviors are included in the grade. An example of four students and their scores on ten different assessments provided from O'Conner (2002) titles, "Issues with the Mean" can be found in Table 4. The chart gives a clear example of how using averages in a grading system can be heavily influenced by behaviors as well as the pace the student learns. In a traditional-based grading system, all grades are counted

and if a student does poorly on any assessment as depicted in Table 4, their grade could be misrepresented. O'Connor (2002) points out that in this chart the median score for Jennifer and Karen are higher, but still in a traditional-based grading system where all assignments and assessments are averaged, each student would receive the same grade.

Table 4
Issues with the Mean

Assessments in Order	Karen	Alex	Jennifer	Stephen
Assessment # 1	0	63	0	0
Assessment # 2	0	63	10	0
Assessment # 3	0	63	10	62
Assessment # 4	90	63	10	62
Assessment # 5	90	63	100	63
Assessment # 6	90	63	100	63
Assessment # 7	90	63	100	90
Assessment # 8	90	63	100	90
Assessment # 9	90	63	100	100
Assessment # 10	90	63	100	100
Total	630	630	630	630
Mean	63%	63%	63%	63%
Median	90%	63%	100%	63%

Note: O'Connor (2002, pg. 142)

Related studies involving traditional grading

When looking at traditional-based grading practices and current research, not much exists in relation to state test scores specifically. Recent research by Ussery (2014) studied and concluded that traditional-based grading practices had a correlation with the MAP test in mathematics. She examined research and literature that would advocate for a change in grading practice within her district. Ussery (2014) stated that the problem and reason for the research

was to see if there was a gap between MAP scores and grades. Ussery (2014) stated that if there was a gap between MAP scores and grades, that teachers needed to be educated on other practices that show true student achievement and growth. Ussery (2014) when conducting her research, rejected the null hypotheses of "There is no relationship between mathematics class grades and MAP scores." Although this study showed evidence that traditional-based grading did correlate to MAP scores in mathematics in this researcher's data set, the researcher did not look at data to see if other grading practices had a stronger correlation.

Another study titled "Criterion-referenced grading vs. traditional grading: Using grades to Predict Summative Test performance" looked at two grading practices and their relationships to summative common summative assessments at the end of a unit of instruction. Comes (2016), examined the two grading practices of traditional-based grading, where the grade was averaged to produce a score, and criterion-referenced grading where grades are broken down learning targets and students scored on a four-point rubric. Within the study, Comes (2016) concluded through a correlation study that although correlations existed in both, traditional-based grading where averaging was completed had a stronger correlation than grades produced by criterion-referenced grading. Recent research would imply that traditional-based grading does have a relationship with grading both in a summative level on state testing and at a summative level within a building.

Standards-Based Grading

Characteristics of standards-based grading

Marzano (2010) defines standards-based grading as grading that that looks at certain topic areas within a subject, but then when assigning a grade uses the practice of placing students in a performance category. Marzano (2010) states that placing the student in a performance

category in standards-based grading is done instead of using an average of all assignments and assessments form the course to produce a letter grade. The performance categories Marzano (2010) talks about are levels that identify the student's progress toward the specific topic area within a subject or standard. The popular categories that educators use in a standards-based system to identify a student's grade are typically advanced, proficient, basic and below basic according to Marzano (2010). Assigning a grade that is not made up of averages of assignments and assessments is a big shift in grading, but standards-based grading has several other components to it that differ from a traditional grading system. A five-point scale example presented in Table 5 by Shimmer (2016) represents some common terminology that can be used to indicate the levels in a standards-based grading system. The chart provides a visual to show how the levels of learning that are traditionally A,B,C,D and F can be represented in standards-based grading. In addition to an example of the five-point scale, Table 6, titled "Five-point scale with descriptions example" includes an example from Shimmer (2016) with general descriptions of each achievement level within standards-based grading. These levels are similar to the achievement levels assigned to students on the GL MAP test as well as the EOC exams.

Table 5.
Five-point scale examples

0	1	2	3	4
F	D	C	B	A
Insufficient	Novice	Developing	Proficient	Advanced
Not yet	Beginner	Emerging	Competent	Distinguished
Not there	Minimal	Acceptable	Accomplished	Exemplary
Below Basic	Basic	Apprentice	Practitioner	Expert
Undrafted	Rookie	Professional	All star	Hall of fame

Note: Shimmer (2016, pg.109)

Table 6.
Five-point scale with descriptions example

Level	General Description
Advanced	Students at the advanced level have reached a level of mastery over the grade-level standards. They are able to apply and adapt to authentic, atypical, or unpredictable situations or circumstances. These students can draw upon their conceptual understanding to solve real problems that show a level of creativity and sophistication. These students are able to accurately self-assess and have a depth of understanding that seamlessly connects related or previously explored concepts.
Proficient	Students at the proficient level independently demonstrate competence within the standards. Whether basic or sophisticated, these students have met the standards and are capable of selecting the appropriate strategy for most atypical situations or circumstances. With assistance, these students can occasionally apply their proficiency to more authentic situations or circumstances. While they haven't consistently achieved more advanced demonstrations, these students have fully met the expectations of the intended learning.
Developing	Students at the developing level are those who inconsistently demonstrate an understanding of the grade-level standards but require assistance and guidance to reach full proficiency. Connections to related or previously explored concepts are minimal or inconsistent. Developing students will occasionally reach the proficient level on some standards, but will also demonstrate learning at the novice level. These students have some transferable skills and a limited conceptual understanding that goes beyond right / wrong.
Novice	Students at the novice level are those who can only demonstrate a very basic understanding of the grade-level standards and concepts. These students are at the beginning stages of learning; explanations and demonstrations are task specific, inconsistent, linear, and isolated in that they show little connection to any related or previously explored concepts. These students operate at the recall and replication level.
Insufficient	Students at the insufficient level have not submitted the requisite amount of evidence to justify a passing level. Either whole pieces of evidence are missing or the submitted evidence is incomplete or incorrect.

Note: Shimmer (2016, pg.110)

Shimmer (2016), an advocate for standards-based grading and the removal of student behaviors from a grade, argues that to shift grading practices, that educators must put three components together when assigning a grade: students should receive full credit for what they know, the term accountability needs to be redefined in education and the reason for homework needs to be reevaluated. Shimmer's (2016) discussion of the three components speaks to the behavior of a student being removed from a grade and the mark representing academically where a student falls on a standard or specific topic area within a subject. O'Connor (2002) states that effort, student participation and attitude need to all be reported separately from the academic grade that is related to the standard. Standards-based grading does not count homework or practice as part of the grade. The grading process recognizes that practice is necessary for improvement and does not average the practice into the academic mark. The student is also not penalized academically for not completing homework or practice. Removing non-academic factors such as poor behavior or poor practices of a student from the grade allows the assigned level of achievement to really represent the student's achievement on a certain standard. Again, O'Connor (2010) states that grades should only be a student's achievement on the standard and that behaviors should be reported to parents separately. Reporting grades in this manner more clearly represents and reports the student's cognitive ability within that subject.

Standards-based grading also focuses highly on the process of learning for each student. Within standards-based grading, formative assessments, or checks for understanding throughout the instruction help guide the learning process. O'Connor (2002) says that assessments should only be included in an overall grade if it is tied to a standard and students have been able to practice the skill or standard a sufficient amount. Students in standards-based grading are also allowed to redo work that is not sufficient and asked to relearn when their performance levels are

low on standards. O'Connor (2002) often reminds us that students learn at different rates and do not always achieve their highest the first time they are introduced to a standard. O'Connor (2002) also discusses guidelines of standards-based grading that state that learning is a process that is continuous and that it only matters that students learn, not that they do it by a certain deadline. This theory of O'Connor (2002) and standards-based grading promotes a standard of differentiation for students, but still holds students accountable by making them produce quality work even if it is at a different pace than other students. In regards to having students redo work that is subpar, Scriffiny (2008) states that "We must create an environment where standards can and must be met and where students are not permitted to submit substandard work without being asked to revise" (para. 21). In a traditional grade, the subpar work would be accepted and averaged into the overall grade. The student would then be penalized in their grade for the subpar work, but the teacher also accepts the work from the student. In a standards-based grading approach, this assignment would be redone by the student and only an achievement level would be assigned to it based on the fully completed assignment the second time it was submitted.

Another main characteristic of standards-based grading is not allowing the use of a zero. O'Connor (2002) notes that this aspect of standards-based grading can be the hardest for teachers to let go in their grading practices. Including a zero in a grade can greatly distort the academic mark and lead to issues with accuracy. As Shimmer (2016) states, the "True North" in grading is to not misrepresent the academic mark, which averaging a zero in any data set can do.

Related studies involving standards-based grading

Stringer (2013) concluded through research that MSIP Scores in schools practicing standards-based grading do not produce higher test scores than schools using traditional-based

grading practices. This particular study examined three schools, with two being buildings practicing standards-based grading. The other school practiced traditional grading practices. This research was based around the idea that standards-based grading would be a clearer picture of where students are academically. After conducting the research, Stringer (2016) stated "Although standards- based grading lends itself towards a more reflective approach to a student's academic achievement, it does not lend itself to higher student achievement according to this study" (p28).

In 2014, Katrina Yoakum conducted and analyzed research in the area of standards-based grading and its relationship between the EOC (End of Course) exam. The researcher conducted a qualitative study and looked at high school achievement on the EOC exam in the areas of communication arts and mathematics and looked at those same scores the year after building implementation of standards-based grading. Yoakum (2016) states that the results of the study showed that students in the area of ELA scored lower using the traditional grading system while students in mathematics scored higher when using the standards-based grading approach. This information gives mixed ideas on which grading approach is better when looking at student achievement in one building across two content areas. The growth or the decline in scores in ELA and math could simply be contributed to a different group of students taking the exam as well.

In 2012-2013, Rachel Beth Rosales looked at standards-based grading and student achievement again, but this time in Algebra II in high school. In this study, Rosales (2013) looked at post-test scores from two traditionally graded classrooms and post-test scores from two classrooms using standards-based grading and compared them to the EOC (End of Course) exam looking at achievement. In the study, Rosales (2013) concluded that there was no significant

difference in the two groups. This study again stated that there does not seem to be a higher impact on student achievement when students are graded in a traditional-based system compared to a standards-based grading system. This study, as well as many others in this area go along with with Marzano (2010) when he states "Indeed, at the writing of this book, no major study (that we are aware of) has demonstrated that simply grading in a standards-based manner enhances student achievement" (pg. 18).

Another study by Pollio (2015), conducted research looking at standards-based grading implementation, standardized test scores and demographics of students across 11 high schools. Pollio (2015) examined two data sets with sample sizes of 1,163 students and 1,256 students in the other set. The data set consisted of 11th grade students within an Algebra II course. Within his abstract, Pollio (2015) concluded that the amount of students earning an A or B and passing the state test doubled when using standardized grading practices. Pollio (2015) also concluded that when looking at students who are "at-risk", standards-based grading practices were more predictive of achievement and was a better assessment of learning. This study by Pollio (2015) shows some evidence that standards-based grading could be a better predictor of student achievement levels on state exams.

Summary

This chapter discussed and analyzed standardized testing, traditional-based grading practices, standards-based grading practices. Sections within this chapter discussed the areas of standardized testing, Missouri standardized tests, student achievement levels on the GL MAP test in science, student achievement levels on the Biology EOC exam, accountability to standardized tests, related studies involving standardized testing, reasons for grades, characteristics of traditional-based grading, related studies involving traditional-based grading, characteristics of

standards-based grading and related studies involving standards-based grading. Grading practices and the achievement levels of students on standardized tests have been looked at in several current studies, but only few studies currently have produced any solid evidence that standards-based grading is a more accurate reflection of where a student will score on the end of the year standardized test. This study will help add to the literature that is available related to the analysis of grading practices to determine if more accurate academic marks makes a difference on student achievement levels on standardized tests.

CHAPTER THREE
RESEARCH DESIGN AND METHODOLOGY

Problem and Purposes Overview

In Missouri, like other states, many school districts have formally changed grading practices, but there is lack of information about how these changes have directly impacted teacher-assigned grades and the connection to student achievement on standardized state tests. According to Shimmer (2016), "Anchoring grading practices with a focus on accuracy and confidence leads grading decisions that are on point and aligned with what we know to be in the best interest of student success" (pg. 23). The purpose of this study is to add to the body of knowledge additional research related to teacher-assigned grades and their connection to student achievement levels on standardized tests. By conducting this study, researchers hope to show that schools that formally adopt standard-based grading practices will produce more reliable grades that are reflected in students' standardized test scores. This is important because if accurate student grades are predictive of standardized test scores, schools can make appropriate interventions to improve student achievement. Accurate and meaningful grades can drive instruction; the difference leads to continued student achievement.

Research Questions

- RQ1: Is there a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 5th grade?
- $H_0$1: There is no relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 5th grade.

Rejecting the null hypothesis would indicate there is a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 5th grade.

- RQ2: Is there a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 8th grade?
- $H_0$2: There is no relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 8th grade.

Rejecting the null hypothesis would indicate there is a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 8th grade.

- RQ3: Is there a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in biology?
- $H_0$3: There is no relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in biology.

Rejecting the null hypothesis would indicate there is a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in biology.

- RQ4: Is there a difference in teacher-assigned grades produced using traditional grading practices and grades produced using standards-based grading practices?
- $H_0$4: There is no significant difference in teacher-assigned grades produced using traditional grading practices and grades produced using standards-based grading practices.

Rejecting the null hypothesis would indicate that there is a significant difference teacher-assigned grades produced using traditional grading practices and grades produced using standards-based grading practices.

- RQ5: Is there a difference in teacher-assigned grades produced using standards-based grading practices and student achievement levels on the 8th grade science MAP?
- $H_0$5: There is no significant difference in teacher-assigned grades produced using standards-based grading practices and student achievement levels on the 8th grade science MAP.

Rejecting the null hypothesis would indicate that there is a significant difference in teacher-assigned grades produced using standards-based grading practices and student achievement levels on the 8th grade science MAP.

- RQ6: Is there a difference in teacher-assigned grades produced using traditional grading practices and student achievement levels on the 8th grade science MAP?
- $H_0$6: There is no significant difference in teacher-assigned grades produced using traditional grading practices and student achievement levels on the 8th grade science MAP.

Rejecting the null hypothesis would indicate that there is a significant difference in teacher-assigned grades produced using traditional grading practices and student achievement levels on the 8th grade science MAP.

- RQ7: Are students enrolled in schools that use standards-based grading practices more successful on the 8th grade science MAP than students enrolled in schools that use traditional grading practices?

- $H_0$7: There is no significant difference in student success on the 8th grade MAP between students enrolled in schools that use standards-based grading practices and students enrolled in schools that use traditional grading practices.
- Rejecting the null hypothesis would indicate that there is a significant difference in student success on the 8th grade MAP between students enrolled in schools that use standards-based grading practices and students enrolled in schools that use traditional grading practices.

Study Group

The study group consisted of the 2016-2017 junior class who attended high school within the same school district in Northwest Missouri. Student data were organized by the middle school attended during the 2013-2014 school year. Two sample groups were needed for this study, so students attending the two middle schools within the district with the most similar demographics were selected. One of the middle schools implemented standards-based grading practices and policies during the 2012-2013 school year and continues to use these practices with fidelity, while the other middle schools used traditional grading practices. The group consisted of 294 students who attended the same district from 2010-2016.

Data Collection

Student MAP and EOC student achievement levels were obtained from a district-level report provided by the Missouri Department of Elementary and Secondary Education (MODESE). The report utilized Missouri Student Information System (MOSIS) identification numbers to organize and report student data. Using the same MOSIS identification numbers, corresponding teacher-assigned grades from PowerSchool were attached for each student in the sample. When comparing biology EOC student achievement levels, 8th grade MAP student

achievement levels, and 5th grade MAP student achievement levels, the researchers examined the same students over a period of time. The sample of students for this study are from 2016-2017 junior class currently attending two of the three local high schools. Biology EOC exams were either taken by the students during 2015-2016 or 2014-2015 school years, depending on the year they were enrolled in Biology I. The same group of students took the 8th grade science MAP in 2013-2014 school year and the 5th grade science MAP during the 2010-2011 school year.

Variables Used in the Study

Independent and Dependent Variables were used for all research questions in this study.

Independent Variable: For the research questions, the independent variable was the teacher-assigned grades. The science grades analyzed could have been produced using either traditional and standards-based grading practices for analysis of research question one, two and three. For research questions one, two, and three the variable was divided into three categories based on their grade level when the grades were assigned: 5th grade, 8th grade, and biology (which could have been taken either in 9th or 10th grade).

For research questions four, five and six, the independent variable was also teacher-assigned grades, but the variable was divided into two categories for analysis: 8th grade science grades produced using standards-based grading practices and 8th grade science grades produced using traditional grading practices. For the seventh research question, the variable was divided into two categories: "success" and "non-success".

Teacher-assigned grades were reported using the standard A-F scale. In order for statistical analysis of these grades, the researchers converted the letter grade into a number: A=4, B=3, C=2, D/F=1. Researchers decided to use these conversions to make similar categories to

the four student achievement levels (Advanced, Proficient, Basic, Below Basic) used to describe student performance on the MAP and EOC tests. When students are placed in the "Below Basic" category on state testing, they did not meet the expectation for mastery of the standards. Researchers for this study felt that students who fail to meet academic expectations within the science classroom, would receive grades lower than a C when teachers use traditional grading practices and Basic or Below Basic marks when teachers use standards-based grading practices. Below Basic) using a 4-point scale (Advanced=4, Proficient=3, Basic =2, and Below Basic=1). Scale scores were not used for analysis because the scale score ranges can vary slightly from year to year as determined by the MODESE and the range of scale scores for different student achievement levels is not evenly distributed within the four categories. If the researchers were to analyze these scale scores, it would be difficult to determine if a statistically significant difference exists between the data set and teacher-assigned grades due to this difference in scale score ranges.

For research question four, the dependent variable was the teacher-assigned grade instead of state MAP and EOC achievement levels. Researchers thought it was important to determine if traditional and standards-based grading practices had an affect on the actual teacher-assigned grades in schools and not just achievement levels.

Data Collection and Instrumentation:

Archived data from 2010-2011 5th grade science MAP student achievement levels, 2013-2014 8th grade science MAP student achievement levels; and 2014-2016 biology EOC student achievement levels were retrieved through the Missouri Department of Elementary and Secondary Education website by the district's Assessment Office. Data were also collected from 2010-2011 teacher-assigned 5th grade science grades, 2013-2014 teacher-assigned 8th grade

science grades, and 2014-2016 Biology I teacher-assigned grades through PowerSchool. Individual student data was collected during this study. To protect their anonymity, MOSIS identification numbers were used instead of district-assigned identification numbers. Researchers did not have access to data related to student demographics other than gender during this study. Researchers did not have access to specific teacher information. Teacher-assigned grades could not be linked to specific classrooms, only to buildings, so there was never a treat to teachers' anonymity.

Data Analysis Strategies

A spreadsheet was created using Microsoft Excel© to organize data retrieved from MODESE website and PowerSchool©. All statistical calculations were performed within the Microsoft Excel© spreadsheet using EZAnalyze software.

For research questions one, two, and three, a Pearson Correlation was used to determine if a relationship exists between teacher-assigned grades and student achievement levels. Researchers chose to run three separate Pearson Correlations using 5th grade science MAP, 8th grade science MAP, and Biology EOC student achievement levels and teacher-assigned grades. For this data analysis, researchers compared the Pearson Correlation Value, the Coefficient of Determination (r^2), and the *P* value for each grade level.

- RQ1: Is there a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 5th grade?
- RQ2: Is there a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 8th grade?

- RQ3: Is there a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in biology?

A Paired *t*-test was used for research questions two, three and four to determine if there was a statistically significant difference between student teacher-assigned grades in classrooms utilizing standards-based grading practices and those in classrooms using traditional grading practices and student achievement levels on the state assessments. A Paired *t*-test was selected because the sample used contained matched pairs of data, student teacher-assigned grades and achievement levels on the MAP. For this study, an alpha level of 0.05 was set to determine if there was a statistically significant difference between teacher-assigned grades and state test scores (Kranzler, 2011, p116).

- RQ4: Is there a difference in teacher-assigned grades produced using traditional grading practices and grades produced using standards-based grading practices?
- RQ5: Is there a difference in teacher-assigned grades produced using standards-based grading practices and student achievement levels on the 8th grade science MAP?
- RQ6: Is there a difference in teacher-assigned grades produced using traditional grading practices and student achievement levels on the 8th grade science MAP?

For research questions five, six and seven, Chi Square was used to determine if the a statistically significant difference existed between the actual and expected data. According to Kranzler (2011), Chi-Square is specifically designed to test hypotheses about categorical data (pg 139). Chi-Square was used to determine whether success by students enrolled in schools that

use standards-based grading practices or traditional grading practices are significantly different from what could be expected just by chance at alpha level 0.05.

- RQ5: Is there a difference in teacher-assigned grades produced using standards-based grading practices and student achievement levels on the 8th grade science MAP?
- RQ6: Is there a difference in teacher-assigned grades produced using traditional grading practices and student achievement levels on the 8th grade science MAP?
- RQ7: Are students enrolled in schools that use standards-based grading practices more successful on the 8th grade science MAP than students enrolled in schools that use traditional grading practices?

Summary

This study will attempt to determine if there is a statistically significant difference between teacher-assigned grades and student achievement levels on state standardized tests in order to reject the null hypothesis that there is no significant difference between teacher-assigned grades and student achievement levels on standardized state science tests. This study will also attempt to determine if there is a statistically significant difference between grades produced using standards-based and traditional grading practices. Finally, this study will attempt to determine if students enrolled in schools that use standards-based grading practices more successful on the 8th grade science MAP than students enrolled in schools that use traditional grading practices. Data for this study will be obtained from the Missouri Department of Secondary Education and through PowerSchool©. The results of the tests specified in this section will be discussed in the next chapter.

CHAPTER FOUR
PRESENTATION OF THE DATA ANALYSIS, FINDINGS AND INTERPRETATIONS

Results for Research Question One

RQ1: Is there a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 5th grade?

Research question one inquires whether there is a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments. For this data analysis, researchers compared the Pearson Correlation Value, the Coefficient of Determination (r^2), and the *P* value calculated using Microsoft Excel ©EZAnalyze.

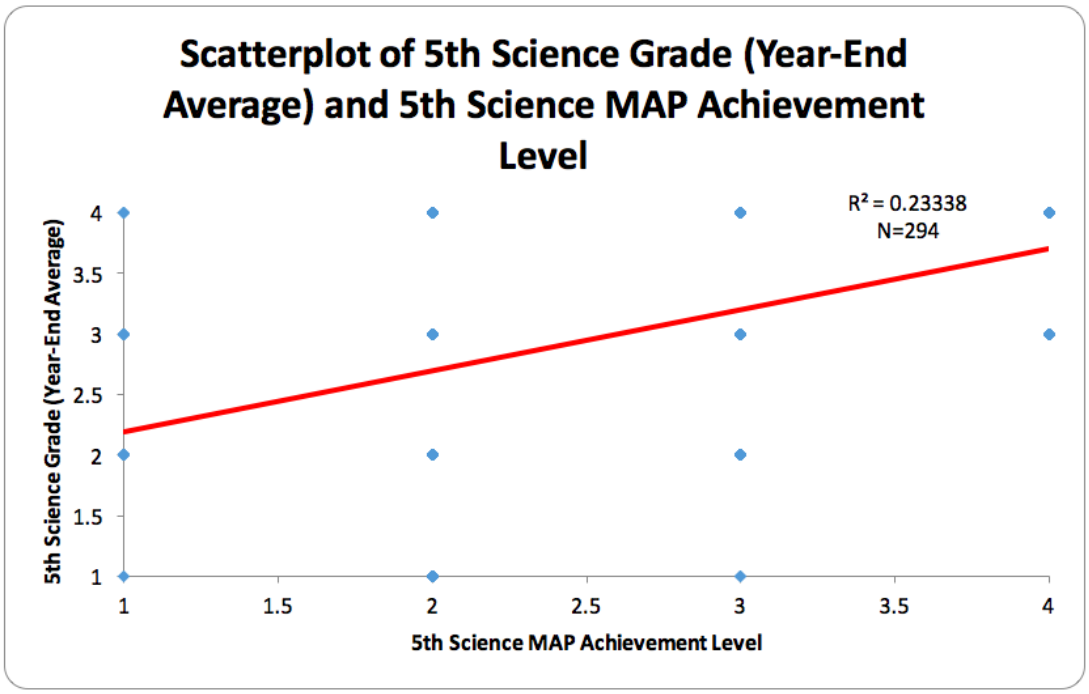
The 5th grade teacher-assigned grades and student achievement levels on the 5th grade science MAP test were analyzed to determine if there was a correlation between teacher-assigned grades and state test scores. The summary of descriptive statistics is shown in Table 7. The teacher-assigned year-end science grade was compared to the student achievement levels the student received on 5th grade MAP.

Table 7: Pearson Correlation: 5th grade year-end average teacher-assigned science grades vs 5th grade science MAP achievement levels

Pearson Correlation	.483
N	294.000
P	.000
R^2	0.23338

A scatterplot produced using Microsoft Excel ©EZAnalyze that compares the 5th grade year-end average to the achievement levels the student received on the 5th grade MAP is shown in Figure 1. This figure shows the linear relationship between the year-end grade and MAP achievement levels for all 5th grade students in this study.

Figure 1: Scatterplot: 5th grade year-end average teacher-assigned science grades vs. science MAP student achievement levels



Summary for Research Question One

Based on the Pearson Correlation value of +.30 has a weak positive correlation, +0.80 to +0.90 have a strong positive correlation and +1 is said to have perfect correlation (Kranzler, 2011, p82). The Pearson Correlation calculated value of .483 indicates a moderate positive relationship between teacher-assigned grades and science MAP student achievement levels for the 5th grade students in this study. According to Kranzler (2011), The Coefficient of Determination, r^2 value, is used to describe "the percentage of variance in one variable that is "accounted for" by knowing the value of the other variable". In 5th grade science, only 23.338%

of the student MAP achievement level can be attributed to the teacher-assigned grade. The calculated P-value for 5th grade was .000 which is less than 0.05 therefore, the observed correlation was statistically significant. Researchers must reject the null hypothesis there is no relationship between teacher-assigned grades and student achievement levels on standardized state 5th grade science assessment.

Results for Research Question Two

- RQ2: Is there a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 8th grade?

Research question two inquires whether there is a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in 8th grade science. For this data analysis, researchers compared the Pearson Correlation Value, the Coefficient of Determination (r^2), and the *P* value calculated using Microsoft Excel ©EZAnalyze.

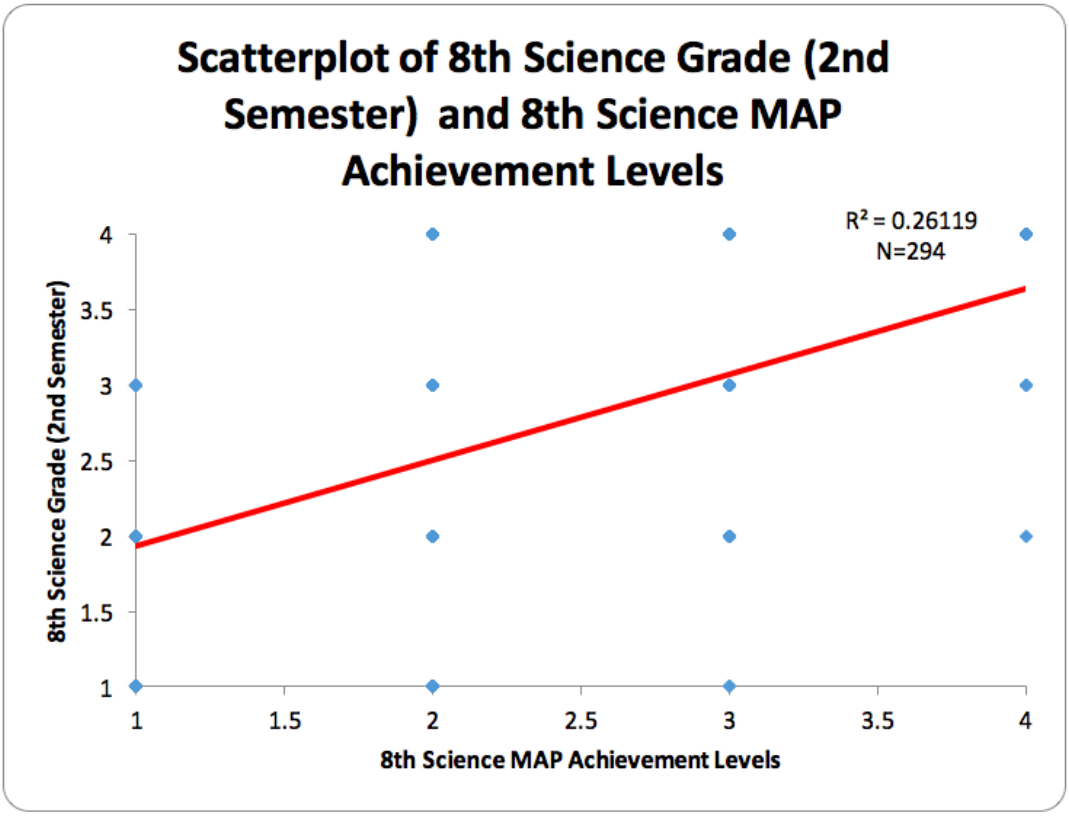
The 8th grade teacher-assigned grades and student achievement levels on the 8th grade science MAP test were analyzed to determine if there was a correlation between teacher-assigned grades and state test scores. The summary of descriptive statistics is shown in Table 8. The teacher-assigned second semester science grade was compared to the student achievement levels the student received on 8th grade science MAP.

Table 8: Pearson Correlation: 8th grade second semester average teacher-assigned science grades vs 8th grade science MAP achievement levels

Pearson Correlation	.511
N	294.000
P	.000
R^2	0.26119

A scatterplot produced using Microsoft Excel ©EZAnalyze that compares the 8th grade second semester average to the achievement levels the student received on the 8th grade science MAP is shown in Figure 2. This figure shows the linear relationship between the second semester grade and MAP achievement levels for all 8th grade students in this study.

Figure 2: Scatterplot: 8th grade 2nd semester average teacher-assigned science grades vs. science MAP student achievement levels



Summary for Research Question Two

The Pearson Correlation calculated value of .511 indicates a moderate positive relationship between teacher-assigned grades and science MAP student achievement levels for the 8th grade students in this study. In 8th grade science, only 26.119% of the student MAP achievement level can be attributed to the teacher-assigned grade. The calculated P-value for 8th

grade was .000 which is less than 0.05 therefore, the observed correlation were statistically significant. Researchers must reject the null hypothesis there is no relationship between teacher-assigned grades and student achievement levels on standardized state 8th grade science assessment.

Results for Research Question Three

- RQ3: Is there a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in biology?

Research question three inquires whether there is a relationship between teacher-assigned grades and student achievement levels on standardized state science assessments in biology. For this data analysis, researchers compared the Pearson Correlation Value, the Coefficient of Determination (r^2), and the *P* value calculated using Microsoft Excel ©EZAnalyze.

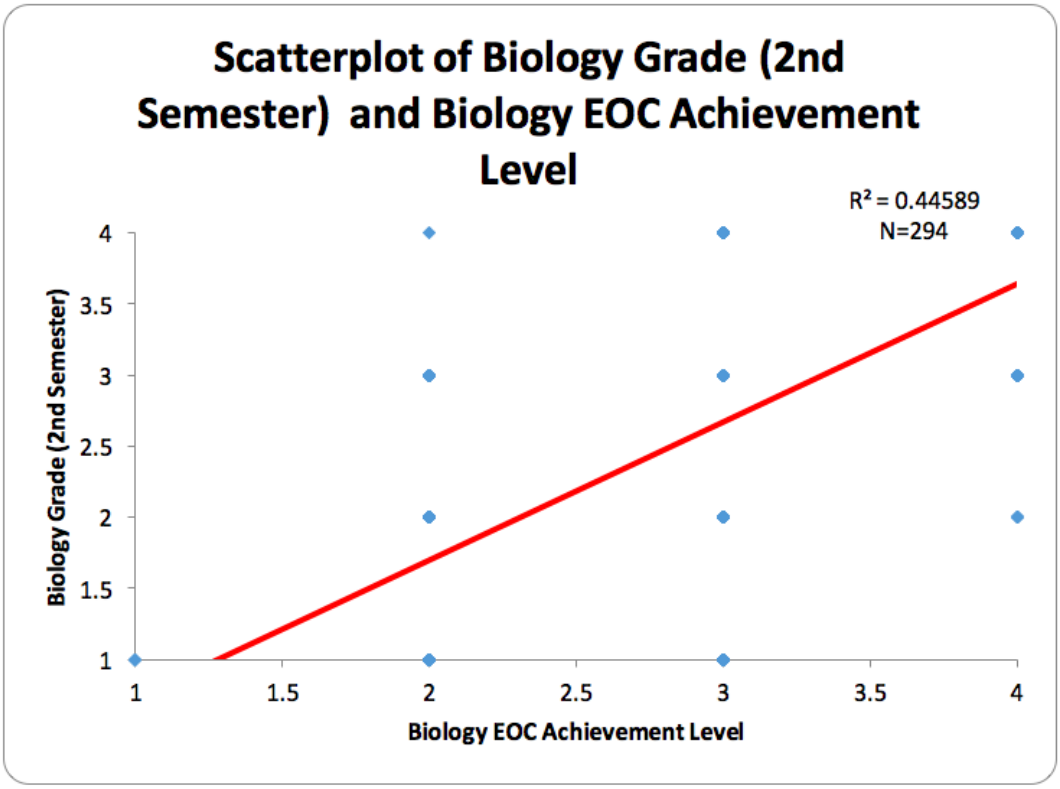
The Biology I teacher-assigned grades and student achievement levels on the biology EOC were analyzed to determine if there was a correlation between teacher-assigned grades and state test scores. The summary of descriptive statistics is shown in Table 9. The teacher-assigned second semester science grade was compared to the student achievement levels the student received on biology EOC.

Table 9: Pearson Correlation: Biology 2nd semester average teacher-assigned science grades vs biology EOC achievement levels

Pearson Correlation	.668
N	294.00
P	.000
R^2	0.44589

A scatterplot produced using Microsoft Excel ©EZAnalyze that compares the biology second semester average to the achievement levels the student received on the biology EOC is shown in Figure 3. This figure shows the linear relationship between the second semester grade and EOC achievement levels for all Biology I students in this study.

Figure 3: Scatterplot: Biology second semester average teacher-assigned science grades vs. biology EOC student achievement levels



Summary for Research Question Three

The Pearson Correlation calculated value of .668 indicates a moderate positive relationship between teacher-assigned grades and biology EOC student achievement levels for the high school students in this study. In Biology, only 44.589% of the student Biology EOC

achievement level can be attributed to the teacher-assigned grade. The calculated P-value for biology was .000 which is less than 0.05 therefore, the observed correlation were statistically significant. Researchers must reject the null hypothesis there is no relationship between teacher-assigned grades and student achievement levels on standardized state biology assessment.

When examining the R^2 values, 44.589% of high school biology EOC student achievement levels can be attributed to the teacher-assigned grades, which is 18.47% more than 8th grade scores and 21.209% more than 5th grade scores. The observed difference in R^2 values could be due to the level of content expertise in high school biology course versus science generalists in middle school and limited number of science content experts in typical elementary classrooms.

Results for Research Question Four

- RQ4: Is there a difference in teacher-assigned grades produced using traditional grading practices and grades produced using standards-based grading practices?
- $H_0$4: There is no significant difference in teacher-assigned grades produced using traditional grading practices and grades produced using standards-based grading practices.

Research question four inquires whether there is a difference between teacher-assigned grades produced using traditional grading practices and grades produced using standards-based grading practices. A Paired *t*-test was ran using Microsoft Excel ©EZAnalyze software to determine if there was a statistically significant difference between the mean student teacher-assigned grades in classrooms utilizing standards-based grading practices and those in

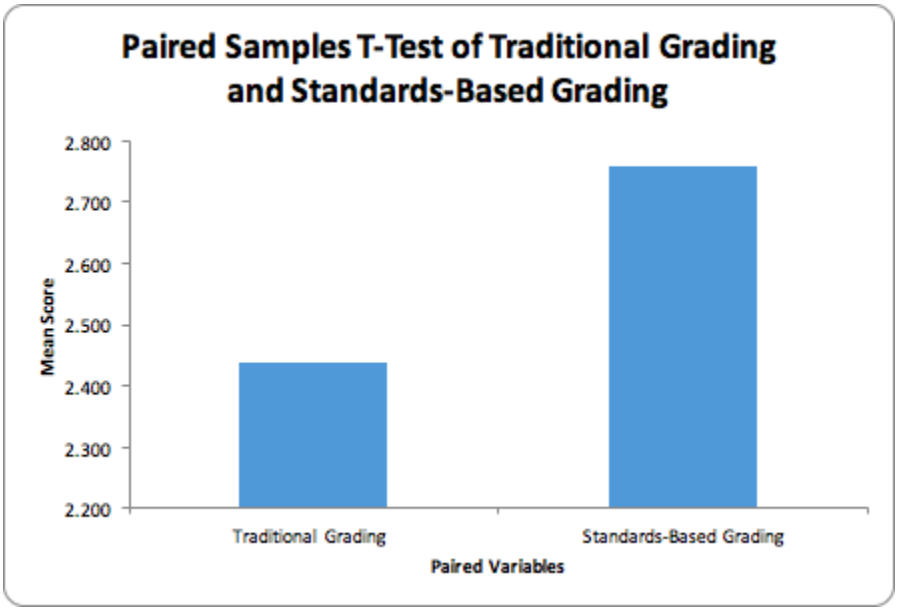
classrooms using traditional grading practices and the mean student achievement levels on the state assessments. A summary of the descriptive statistics comparing the means of 8th grade second semester teacher-assigned grades produced using traditional grading practices to grades produced using standards-based grading practices from the paired *t*-test is shown in Table 10. The mean teacher-assigned second semester average produced using traditional grading practices was 2.438 (using a 4 point scale) while the mean score for grades produced using standards-based grading practices was 2.760 (using the same 4 point scale).

Table 10: Paired Samples *t*-test of 8th grade second semester averages produced using traditional and standards-based grading practices

	8th Grade 2nd Semester Average Traditional Grading	8th grade 2nd Semester Average Standards-Based Grading
Mean	2.438	2.760
Std. Dev.	.930	.796
N Pairs	121	
Mean Difference	-.322	
SE of Difference	.102	
Eta Squared	.077	
T-Score	3.167	
P	.002	

A graph produced using Microsoft Excel ©EZAnalyze that compares the mean 8th grade second semester teacher-assigned science grades produced using traditional grading practices to the mean 8th grade second semester teacher-assigned science grades produced using standards-based grading practices is shown in Figure 4. The difference in the means is 0.322.

Figure 4: Graph of the Paired Samples *t*-test for mean teacher-assigned grades produced using traditional and standards-based grading practices



Summary for Research Question Four

Based on the *t*-test of mean differences and ETA-squared findings, there is a statistically significant difference (P=0.002) between teacher-assigned grades produced using traditional and standards-based grading practices. Alpha level was set by the researchers at 0.05. Since the observed P-value of 0.002 was less than alpha, researchers can conclude that the means are statistically different from each other and must reject the null hypothesis that there is no significant difference in teacher-assigned grades produced using traditional grading practices and grades produced using standards-based grading practices.

Results for Research Question Five

- RQ5: Is there a difference in teacher-assigned grades produced using standards-based grading practices and student achievement levels on the 8th grade science MAP?
- $H_0$5: There is no significant difference in teacher-assigned grades produced using standards-based grading practices and student achievement levels on the 8th grade science MAP.

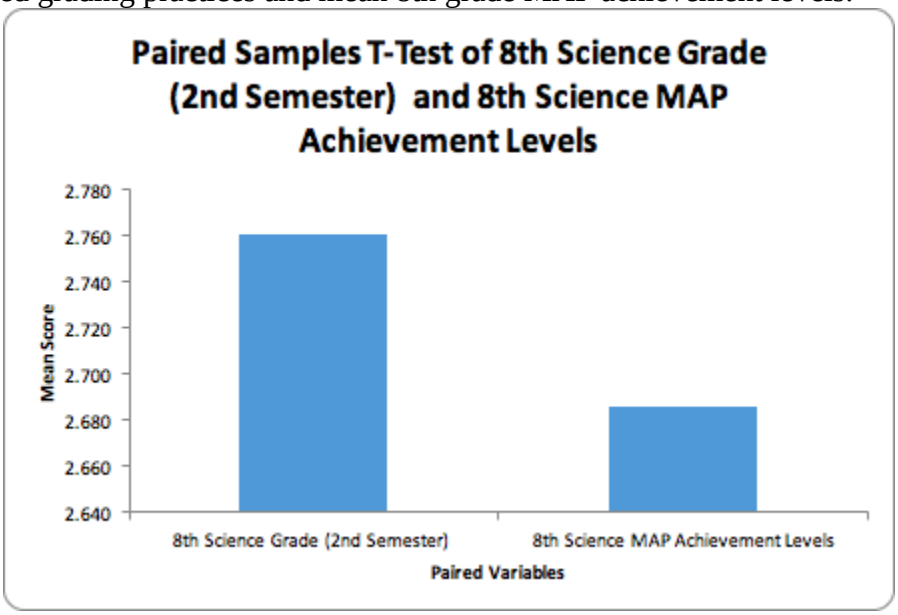
Research question five inquires whether there is a difference between teacher-assigned grades produced using standards-based grading practices and student achievement levels on the 8th grade MAP. A Paired *t*-test was ran using Microsoft Excel ©EZAnalyze software to determine if there was a statistically significant difference between the mean student teacher-assigned grades in classrooms utilizing standards-based grading practices and the mean student achievement levels on the 8th grade MAP. A summary of the descriptive statistics comparing the means of 8th grade second semester teacher-assigned grades produced using standards-based grading practices from the paired *t*-test is shown in Table 11. The mean teacher-assigned second semester average produced using standards-based grading practices was 2.760 (using a 4-point scale) while the mean 8th grade science MAP achievement level was 2.686 (using the same 4-point scale).

Table 11: Paired Samples *t*-test of 8th grade semester averages produced using standards-based grading practices and MAP achievement levels

	8th grade 2nd Semester Average	8th grade MAP Achievement Levels
Mean	2.760	2.686
Std. Dev.	.796	.764
N Pairs	121	
Mean Difference	.074	
SE of Difference	.058	
Eta Squared	.014	
T-Score	1.289	
P	.200	

A graph produced using Microsoft Excel ©EZAnalyze that compares the mean 8th grade second semester teacher-assigned science grades produced using standards-based grading practices to the mean achievement level on the 8th grade science MAP is shown in Figure 5. The difference in the means is 0.074.

Figure 5: Graph of the Paired Samples *t*-test for mean teacher-assigned grades produced standards-based grading practices and mean 8th grade MAP achievement levels.



Summary for Research Question Five

Statistical analysis was conducted using a paired *t*-test to determine if the means of the two groups of scores differ to a statistically significant degree. Based on the *t*-test of mean differences and ETA-squared findings, there is no statistically significant difference (P=.200) between teacher-assigned grades produced standards-based grading practices and the achievement levels on the 8th grade science MAP. Alpha level was set by the researchers at 0.05. Since the observed P-value of 0.200 was greater than alpha, researchers can conclude that the means are not statistically different from each other and must accept the null hypothesis that there is no significant difference in teacher-assigned grades produced using standards-based grading practices and student achievement levels on the 8th grade science MAP.

Results for Research Question Six

- RQ6: Is there a difference in teacher-assigned grades produced using traditional grading practices and student achievement levels on the 8th grade science MAP?
- $H_0$6: There is no significant difference in teacher-assigned grades produced using traditional grading practices and student achievement levels on the 8th grade science MAP.

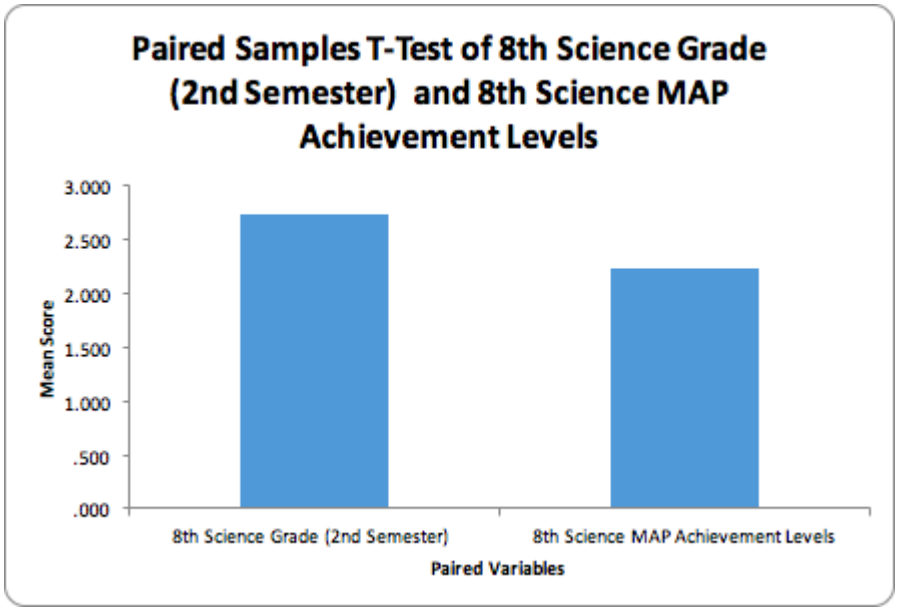
Research question six inquires whether there is a difference between teacher-assigned grades produced using traditional grading practices and student achievement levels on the 8th grade MAP. A Paired *t*-test was ran using Microsoft Excel ©EZAnalyze software to determine if there was a statistically significant difference between the mean student teacher-assigned grades in classrooms utilizing traditional grading practices and the mean student achievement levels on the 8th grade MAP. A summary of the descriptive statistics comparing the means of 8th grade second semester teacher-assigned grades produced using traditional grading practices from the paired *t*-test is shown in Table 12. The mean teacher-assigned second semester average produced using standards-based grading practices was 2.728 (using a 4 point scale) while the mean 8th grade science MAP achievement level was 2.231 (using the same 4 point scale).

Table 12: Paired Samples *t*-test of 8th grade semester averages produced using traditional grading practices and MAP achievement levels

	8th grade 2nd Semester Average	8th grade MAP Achievement Levels
Mean	2.728	2.231
Std. Dev.	.977	.802
N Pairs	173	
Mean Difference	.497	
SE of Difference	.072	
Eta Squared	.217	
T-Score	6.927	
P	.000	

A graph produced using Microsoft Excel ©EZAnalyze that compares the mean 8th grade second semester teacher-assigned science grades produced using traditional grading practices to the mean achievement level on the 8th grade science MAP is shown in Figure 6. The difference in the means is 0.497.

Figure 6: Graph of the Paired Samples *t*-test for mean teacher-assigned grades produced using traditional grading practices and mean 8th grade MAP achievement levels.



Summary for Research Question Six

Statistical analysis was conducted using a paired *t*-test to determine if the means of the two groups of scores differ to a statistically significant degree. Based on the *t*-test of mean differences and ETA-squared findings, there is a statistically significant difference (P=.000) between teacher-assigned grades produced using traditional grading practices and the achievement levels on the 8th grade science MAP. Alpha level was set by the researchers at 0.05. Since the observed P-value of 0.000 was less than alpha, researchers can conclude that the means are statistically different from each other and must reject the null hypothesis that there is no significant difference in teacher-assigned grades produced using traditional grading practices and student achievement levels on the 8th grade science MAP.

Further Analysis of RQ5 and RQ6 using Chi Square

After the researchers analyzed the data related to questions five and six, they determined the need for additional analysis to determine whether the observed difference in the standards-based and traditional grading practices groups were significantly different from what could be expected just by chance. The researchers examined the original data and divided the students into one of two categories (Standards-Based and Non-Standards Based) based on the grading practices used in the classroom during their 8th grade science class. Once each student in the data set was placed into the appropriate group, then the MAP student achievement levels could be compared. Researchers wanted to know whether the observed distribution was significantly different from what one might expect, by chance, in the total population of students. According to Kranzler (2011), using Chi Square "provides a test of the discrepancy between expected and obtained frequencies(pg.142).

The results of the Chi Square Test produced using Microsoft Excel ©EZAnalyze to see if the the actual difference in 8th grade science MAP achievement levels between students who attended a school that used traditional or standards-based grading practices compares to the expected achievement of students is displayed in Table 13. When comparing the MAP student achievement levels between students' whose science grades were produced using non-standards-based grading practices and standards-based grading practices, 17 students performed better than expected in the Advanced and Proficient groups combined in the Standards-Based group while 17 students performed worse than expected in the Advanced and Proficient groups combined in the Non-Standards-Based group.

Table 13: Chi Square: MAP Achievement levels and Grading Practices

MAP Achievement Levels		Non-Standards Based	Standards-Based	Raw Total	Incremental Chi Square
1	Actual	**32**	**6**	38	10.097
	Expected	*22.361*	*15.639*		
2	Actual	**77**	**42**	119	1.689
	Expected	*70.024*	*48.976*		
3	Actual	**56**	**57**	113	4.023
	Expected	*66.493*	*46.507*		
4	Actual	**8**	**16**	24	6.449
	Expected	*14.122*	*9.878*		
Columns	Total	**173**	**121**	294 Grand Total	22.258 Chi Square total
DF 3 P .000					

Summary of Chi-Square Analysis for RQ5 and RQ6

Statistical analysis was conducted using Chi-Square to determine whether the observed distribution was significantly different from what one might expect, by chance, in the total population of students. Based on Chi-Square, there is a statistically significant difference between student achievement levels on the 8th grade science MAP between the standards-based and the non-standards-based groups. Alpha level was set by the researchers at 0.05. Since the observed Chi-Square was 22.258 which is greater than the critical value of Chi-Square 7.82, therefore the difference in groups is significant (X^2=22.258, df=3, p=.000) (Kranzler, 2011. Pg 176). The researchers must reject the null hypothesis that there is no significant difference in grading practices and student achievement levels on the 8th grade science MAP.

Results for Research Question Seven

- RQ7: Are students enrolled in schools that use standards-based grading practices more successful on the 8th grade science MAP than students enrolled in schools that use traditional grading practices?
- $H_0$7: There is no significant difference in student success on the 8th grade MAP between students enrolled in schools that use standards-based grading practices and students enrolled in schools that use traditional grading practices?

Research question seven inquires whether students enrolled in schools that use standards-based grading practices are more successful on the 8th grade science MAP than students enrolled in schools that use traditional grading practices. Student scoring Advanced or Proficient achievement levels on the 8th grade science MAP were categorized as "success", while students scoring Basic or Below Basic were categorized as "non-success" so researchers could use Chi-Square within Microsoft Excel ©EZAnalyze software to determine whether the observed difference in the standards-based and traditional grading practices groups and MAP achievement levels were significantly different from what could be expected just by chance.

The results of Chi Square conducted using Microsoft Excel ©EZAnalyze related to the type of grading practices utilized within a school and student success on the 8th grade MAP is displayed in Table 14. The study group contained a total of 294 8th grade science students with 173 students in the traditional grading group and 121 students in the standards-based grading group. When comparing the MAP student success between students' whose science grades were produced using traditional grading practices and standards-based grading practices, 17 students performed better than expected in the "Success" group in the school using standards-based

grading practices while 17 students performed worse than expected in the "Success" groups in the schools with traditional grading practices.

Table 14: Chi Square table of success/non-success on 8th grade MAP and grading practices

Student 8th Grade MAP Achievement		Traditional Grading Practices	Standards-Based Grading Practices	Row Total	Incremental Chi Square
Non-Success	Actual	**109**	**48**	157	7.261
	Expected	*92.384*	*64.616*		
Success	Actual	**64**	**73**	137	8.321
	Expected	*80.616*	*56.384*	294 Grand total	15.582 Chi Square total
DF=1 P=.000					

Summary for Research Question Seven

Based on Chi-Square, there is a statistically significant difference (P=.000) between student success on the 8th grade science MAP when students are enrolled in schools that use standards-based grading practices and students enrolled in schools that use traditional grading practices. Alpha level was set by the researchers at 0.05. Since the observed Chi-Square was 15.582 which is greater than the critical value of Chi-Square 3.84, therefore the difference in groups is significant (X^2=15.582, df1, p=.000) (Kranzler, 2011, pg. 176). The researchers must reject the null hypothesis that there is no significant difference between student success on the 8th grade science MAP when students are enrolled in schools that use standards-based grading practices and students enrolled in schools that use traditional grading practices.

CHAPTER FIVE
CONCLUSIONS, IMPLICATIONS, AND NEW LEARNING

Overview

The researchers' purpose of this study was designed to provide information and analysis on the effects of implementation of standards-based grading practices when examining actual student performance in the classroom and on standardized state science assessments at various grade levels. Furthermore, the study seeks to identify if a statistically significant difference exists between teacher-assigned classroom grades and standardized state science achievement levels for schools that have formal standards-based grading practices and policies as compared to schools who use more traditional grading practices.

Discussion of Findings

The results of this study suggest that there was a statistically significant difference in student academic performance in the science classroom as well as student performance on the standardized state science assessments when comparing schools that use standards-based and traditional grading policies. Students who attended schools that utilized traditional grading practices had a mean science semester average of 2.438 on a four-point scales. Students who attended schools that utilized standards-based grading practices has a mean science semester 2.760 on a four-point scale. The difference in means was analyzed and reported in Table 10 and the difference was statistically significant ($p=0.002$). In addition, the study suggested that students who attended schools that utilized standards-based grading practices grades were reflective of their achievement levels on the standardized state science assessment. The mean student science grade was 2.670 on a four-point scale while their mean achievement level on the state assessment was 2.686. The difference in means was analyzed and reported in Table 11 and

the difference was not statistically significant (p=0.200). For students who attended schools using traditional grading practices, the mean science grade was 2.728 and their mean achievement level on the state test was 2.231. The difference in means was analyzed and reported in Table 12 and the difference was statistically significant (p=.000). Further evidence can be found in Tables 13 and 14 to suggest a statistically significant difference in student performance on standardized state science tests between students who attend a school that uses standards-based grading practices and students who attend a school that uses traditional grading practices.

Conclusions

In this study, researchers found that teachers who use standards-based grading practice produce grades that are more reflective of student performance on standardized state assessments. Furthermore, researchers found that schools that use these practices show greater student success on standardized state assessments.

The statistical results of the research questions one, two and three suggests that there is a relationship between teacher-assigned grades and student achievement levels on standardized state assessments. Research question four suggests there is a significant difference in teacher-assigned grades produced using traditional grading practices and grades produced using standards-based grading practices. Research question five suggests no significant difference in teacher-assigned grades produced using traditional grading practices and student achievement levels on the 8th grade science MAP. Research question six suggests that there is a significant difference in teacher-assigned grades produced using traditional grading practices and student achievement levels on the 8th grade science MAP. Research question seven suggests that there is a significant difference between student success on 8th grade science MAP when students are

enrolled in schools that use standards-based grading practices and students enrolled in schools that use traditional grading practices.

There is a need for a systematic evaluation of teacher-grading practices at all grade levels. Students should have grades that reflect their knowledge of the content. Student academic marks should also reflect their achievement levels on state and national standardized tests. The research of O'Connor (2002), Marzano (2010), Dueck (2014) and Schimmer (2016) provide numerous suggestions that district and building administration as well as individual classroom teachers and departments can use to reflect on grading practices. After reflection, teachers and administration should make research-based suggestions for formal grading policies and procedures that can have lasting impact on student achievement.

Further Research

Further research is necessary to determine the impacts of standards-based grading practices on standardized test scores. The study would benefit from a larger sample which includes student data from districts that have utilized standards-based grading practices across grade levels with fidelity. Examining data related to other content areas as well as science would have provided the additional information researchers needed to see the impact grading practices have on student achievement.

Recommendations for Policy and Practice

The researchers have the following recommendations from the research and data collected related to this study.

Recommendation One

This study analyzed data collected from one school district in Northwest Missouri with one middle school building that has changed practices and established procedures for

implementation of standards-based grading with fidelity for five years prior to the study. The sample that represents traditional grading practices was collected using students in the same district that attended a different middle school. The researchers would recommend a larger sample size that includes student data from districts that fully implement standards-based grading practices across all grade levels.

Recommendation Two

This study examined the impact grading practices had on performance in the science classroom and on the standardized state science tests (MAP and biology EOC). Researchers would recommend that data from other contents such as mathematics and english language arts be analyzed to assure standards-based grading practices are having the same impact on student classroom as well as standardized test performance.

Recommendation Three

This study examined the impact of grading practices on student achievement levels for the state level standardized assessment. Researchers would recommend further study and research on the impact grading practices have on national level standardized testing such as ACT or SAT.

Recommendation Four

Researches originally collected that data for the same students across multiple grade levels to attempt to determine the long term growth of students using standards-based grading practices. Since science content is not assessed at the state level every year, researchers determined the years between tests could have skewed the results and statistical analysis would not provide sufficient evidence to accept or reject hypotheses. Researchers would recommend a

long-term analysis of student success using a continuous data set over multiple years, across all grade levels.

Recommendation Five

During this study, the researchers analyzed student data to determine the difference in student success. The researchers recommend including a teacher and parent survey to see impacts of grading practices beyond test scores and teacher-assigned grades.

Summary

There is a statistically significant difference in student achievement levels in science for students who attend a school that utilizes standards-based grading practices. Substantial research on standards-based grading by O'Connor (2002), Marzano (2010), Dueck (2014) and Schimmer (2016) support the need for grades to be an accurate reflection of student academic achievement aligned specifically to standards. The researchers hope this study and future studies similar to this one are conducted to provide the additional support that Marzano (2010) described when he stated, "Indeed, at the writing of this book, no major study (that we are aware of) has demonstrated that simply grading in a standards-based manner enhances student achievement" (pg. 18).

APPENDIX A

Data Collection Table

Below is a sample data collection table that shows how the data was organized for this study.

MOSIS Id #	Grading Practices during 8th Grade	School Code for current high school	Biology 2nd Semester Grade	Biology EOC Achievement Level	Success/Non-Success Biology EOC
	Standards-based		4	4	Success
	Non-Standards Based		2	2	Non-Success

MOSIS Id #	Grading Practices during 8th Grade	School Code for middle school	8th grade 2nd Semester Grade	8th grade MAP Achievement Level	Success/Non-Success 8th grade MAP
	Standards-based		4	4	Success
	Non-Standards Based		2	2	Non-Success

MOSIS Id #	Grading Practices during 8th Grade	School Code for elementary school	5th grade 2nd Semester Grade	5th grade MAP Achievement Level	Success/Non-Success 5th grade MAP
	Standards-based		4	4	Success
	Non-Standards Based		2	2	Non-Success

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