USING STUDENT SELF-ASSESSMENT SCORING GUIDES TO IMPROVE STUDENT SELF-EFFICACY AND ACHIEVEMENT

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Abstract

In America's schools today, there is an ever-increasing pressure to ensure that all students are achieving success. It has become critically important for K-12 students to have obtained the skills necessary to achieve post-secondary success when they graduate from high school, whether in college or in a career. In order for students to gain the knowledge and skills necessary for that success, it is important for teachers to investigate new ways to reach all students. While there can be many factors that make it challenging for students to be successful, such as socioeconomics, aptitude, and intellectual ability, none are more powerful than an individual's innate sense of motivation. Motivation, and its impact on an individual's self-efficacy, has been studied for several decades. Albert Bandura first coined the phrase, self-efficacy, as he sought to understand more about why some individuals are more successful than others. Examining the importance of self-efficacy, especially as adolescents are beginning to understand more about themselves and their own learning abilities, can make an impact on student achievement. Several research studies have shown that students with higher self-efficacy will have higher achievement. While there are several ways to build an individual's self-efficacy, research shows that mastery experiences have the largest impact on self-efficacy. One way to use mastery experience activities to boost self-efficacy is to allow students to self-assess.

The purpose of this study was to investigate the impact that self-assessment scoring guides had on student achievement and student self-efficacy. The type of self-assessment treatment that was utilized for this study consisted of a standards-based, self-scoring guide. Students enrolled in a high school biology class were divided into two groups, a treatment group

and a control group. The first research question in this study addressed the impact of the self-scoring guide treatment on student achievement. The students in the treatment group were given the self-scoring guides to track their own academic progress during a unit of study. Then, they were given a standardized assessment covering the standards within the unit being studied and were allowed to self-score several times; once before the unit began, twice during the unit, and once after the unit had concluded. Their achievement scores were recorded before and after the unit of study in order to analyze their achievement as a result of self-assessment using a t-test analysis. The control group did not receive the self-scoring guide treatment but, they were administered the same standardized assessment at the beginning and the end of the unit of study, and their scores were also recorded and analyzed using the t-test. The findings discussed in Chapter 4 of this dissertation indicates a greater impact on student achievement for students in the treatment group as compared to students in the control group.

The second research question in this study addressed the impact of the self-scoring guide treatment on student self-efficacy. Both the treatment group and the control group were administered the self-efficacy subscale for the *Motivational Strategies Learning Questionnaire (MSLQ)*, once before the unit of study and once after the unit of study. Each time participants' mean scores were calculated and recorded. The t-test was utilized to investigate the impact that self-scoring had on self-efficacy. The data analysis demonstrated that students who were given the treatment experienced an increase in self-efficacy, whereas those who did not receive the treatment did not increase in self-efficacy. The results obtained from this study further add to the existing research, which indicates that when students are allowed to self-assess they can experience an increase in both self-efficacy and academic achievement. This in turn can

encourage more teachers to adopt self-assessment practices as part of their pedagogy in an effort to improve student success rates.

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Dedication

I want to dedicate this dissertation to my Lord and Savior, Jesus Christ. There were so many times He answered my prayers throughout this process. I have no doubts that without His guiding hands, I would not be here today. Without Him, I would have surely failed! I also want to dedicate this work to the following angels in heaven that I wish could see me graduate: my grandfather Dr. Irvin Lee King who devoted 60+ years to the ministry and exemplified Godliness, my earthly-father George David Watts who was always so supportive of me, my stepfather Lee Roy Goodwin, Jr. who constantly implored me to further my education. Oh how I would love to see them again on graduation day!

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CHAPTER 1: Introduction

Background

The research site is located in a small rural community in the southeast region of Tennessee. There are approximately 1,700 people living within the small, rural town. The community has one elementary school (pre K – 4), one middle school (5-8), and one high school (9-12). There are no major retail or industrial employment opportunities within the city limits of the town and as a result, 57.29% of workers commute 30 minutes or more to work daily. Approximately 22.5% of the population lives at or below the poverty level and the median household income is $36,146 annually. The per capita income is $18,081, which is lower than the state and the national average. According to a 2014 report issued by USA.com, the income growth within the community has increased more than 40% since 2000 and the total population has only grown 2.35% within a 10-year span.

The educational attainment data for the community consist of 71% with a high school diploma or less (35.8% without a high school diploma), 19.6% with some college experience, 2.6% with an associate degree, 2.8% with a bachelor's degree, and 4.1% with a master's degree. According to the ACS (U.S. Census American Community Survey) data rankings, the research community ranks 25th of 424 Tennessee cities with the largest percentage of the population without a high school diploma (USA.com). When compared to the other two communities within the district, the research community has a much higher percentage of the population that has not successfully attained a high school diploma. The overall conditions of the community have not changed much in the last 16 years; other than income growth.

High School Demographics

The current school building was built in 1977 and on average has a student population of approximately 385 students annually. The adult population working within the school consists of the following: 25 certified teachers, 1 principal, 1 assistant principal, 1 guidance counselor and 2 aids. Currently, there are 3 English teachers, 4 Math teachers, 3 Science teachers, 1 Foreign Language teacher, 2 Social Science teachers, 6 CTE (Career Technical Education) teachers, 1 Fine Arts teacher, 1 PE teacher, 1 Drivers Ed. teacher, 1 Library/Media specialist, and 2 Exceptional Ed. teachers.

According to the Tennessee Department of Education (2015), the average number of economically disadvantaged students is more than 72%. However, when scrutinizing at the individual data since 2007, that percentage has steadily increased every year. There is little racial diversity in the school - 97.1 % of the students are white, 1.6% are Hispanic, and 0.5% are African American. Students with disabilities comprise approximately 15% of the student population. The average expenditure per student is $8,686.70 and 95.6% of the classes are taught by highly qualified teachers.

In the past 10 years, 79 faculty members have not returned to their teaching and/or administrative positions for various reasons. This includes classroom teachers, vocational teachers, media specialists, guidance counselors, and administrators. The high teacher turnover the school experiences seems to be a recurring problem that negatively impacts the stakeholders of the school. Retaining highly-qualified teachers for more than two years is difficult for the school. According to The Alliance for Excellent Education (2014), the rate of teachers leaving the school they currently work at or leaving the profession altogether is about “half a million U.S. teachers” which cost about “$2.2 billion annually”.

The attrition rate at the research school is one of several factors that contribute to the lower rate of graduating seniors who pursue a post-secondary education. In addition, more than 75% of students are not scoring at ACT benchmarks. Average ACT scores at the research school have declined over the past four years. The continual training of new teachers every year in which half of these teachers will not continue to teach at the school for more than three years makes it difficult for the school to emphasize school-reform initiatives that are designed to increase student college and career readiness, as well as focus on practices that may improve ACT scores and other accountability data as measured by state mandated tests according to the figures provided by the research school.

For the past five years, the school has experienced dramatic changes in curriculum and instruction, as well as scheduling procedures that have contributed to a decrease in standardized tests scores. At the beginning of the 2016-2017 school year, going into year four, the school has transitioned from a traditional block schedule which had been in place for approximately ten years, to a trimester schedule. Due to limitations relative to faculty and resources, this has been a difficult transition for all stakeholders. In some end-of-course (EOC) classes such as math, language arts and science a 12-week period may occur in which students do not receive instruction due to the trimester schedule. Students have struggled with retaining enough knowledge going into the state mandated EOC exams which has resulted in a drastic drop in scores as compared to pre-trimester EOC data.

This data is relevant and necessary to analyze the curricular profile for the current school year. A subsequent preliminary analysis would lack the foundational context necessary to understand the purpose and necessity of this study. Thus, this information is critical if one

wishes to fully investigate the impact of student self-assessment on student self-efficacy and its effect on student academic progress at the classroom level.

High School Academic Data and Profile

In order to meet the academic needs of the student body via effective classroom instructional activities, it is necessary to scrutinize the historical achievement and growth data of the student body. The following areas of data that will be discussed in this section consist of scores from Algebra I and Algebra II, English I, English II, and English III, Biology I, and U.S. History. Although chemistry was added to the curriculum in the 2013-2014 school year, multi-year analysis is not feasible due to insufficient data. Thus, it is not addressed in this document. In addition to the tested subjects discussed, the data is categorized into two groups; 2007-2012 pre-trimester scheduling and 2013-2014 current trimester scheduling. It is also important to note that in the 2009-2010 school year, major changes were made in baseline scores for the EOC tests (Cardona). In the past four years, the Tennessee Department of Education (TDOE) has revised various areas of testing, including adding Algebra II in 2012 and chemistry in 2014, as well as eliminating the physical science and math foundations EOCs after the 2008 report card.

Prior to these schedule revisions, the Algebra I scores from 2007 - 2012 met state standards for academic growth, with 2011 scores being significantly above the state growth standards. In biology, the scores were consistently above the state standards for academic growth each year other than 2007. During the 2007 school year, there were faculty changes in the Biology department. The language arts department also met academic growth expectations. Tests scores in U.S. History also indicated consistent growth as well, being above state standards each year with the exception of 2007. During this six-year time span, school test scores increased, most significantly in 2011 and 2012. None of the tested subjects were below the state

standards. This may be attributed to an intervention program that began in 2010 in which struggling students were identified and given 30 minutes of intervention during the school day. With a block schedule it was not difficult to build that time into the school day, and the results over the next two years were evidenced by increased EOC scores.

However, during the 2013 school year, the district mandated a new schedule change for high schools referred to as trimester scheduling. In 2013, the student scores for all the tested subjects declined significantly. Test scores in biology and U.S. History, subjects in which students scored significantly well, also declined. For example, test scores in biology ranked between the 90th and 97th percentile, and math scores ranked near the 90th percentile. Many of the students in these courses had not received instruction for 12 weeks (winter term) of that year prior to taking the EOC exams. This had a negative impact on all EOC scores. For example, in biology, during the 2014 school year, there were double the number of students with instructional-time gaps over the previous year (2013), and as a result, those scores indicated a 50% decline from the previous school year. The same teacher has been teaching the class since 2008.

Another factor affecting student achievement occurred when the state changed the cut-off scores for the EOC test in 2010. The number of students proficient/advanced (P/A) declined significantly; Algebra I-51.4%, science-61.9%, and English-60% for 2010. However, this drop was evident in most districts in the state (Roberts). Although the state testing policy changes impacted the high school's scores, there was an upward trend from 2010 to 2012 in math, English and science once teachers learned what the new cut-scores were going to be. In Algebra I the P/A percentage rose to 67.9 in 2011 and 70.1 in 2012. In Biology (2011) the P/A percentage rose to 72.1. In English I and English II the P/A percentage was 67.1 in 2011 and

65.0 in 2012. The math and science testing data experienced the largest shift in increased number of P/A student scores since the 2010 drop. Once again, this may be attributed to the intervention program that was initiated during this time. In addition, there was no teacher turnover in these courses during this time and traditional block scheduling remained in place. By the end of 2012 the school earned unprecedented test scores, including an "A" for writing in 2013 and 2014.

However, for the next two years (2013 and 2014), the school once again experienced a major drop in scores. Although significant personnel changes occurred over the previous eight years, student scores still increased despite the teacher turnover prior to the 2013 and 2014 school years. The only change initiated at school that can be associated with a decline in scores was the implementation of the trimester schedule, perhaps making it more challenging for teachers to adjust classroom instructional activities and pacing. It is interesting to note that the other two high schools in the district on trimester schedule were able to remediate their 12-week learning-time gap problems by ensuring that core courses with standardized tests were taught all three trimesters with no trimester gaps. As a result, scores in these schools improved. Due to this observation and the changes that were made in administration for the 2014-15 school year, the high school in this study began to ensure that all core-tested subjects were scheduled for the entire school year with no gaps. With these changes, the core teachers were ensured of having more time to concentrate on classroom instructional strategies. For example, the biology teacher began to implement a new strategy designed to make students more self-aware of their own learning and growth toward meeting the state standards for the course. She began to use a self-scoring guide that she created based upon the standards being learned within a given unit of study. Since the self-assessment tool has been in use, the EOC scores for biology have begun to

increase again. Although other factors may impact these test scores, the same biology teacher has been providing instruction, trimester scheduling has not changed, and the demographics of the community that the school serves remain the same. Currently, the school continues to use the trimester schedule for all classes for the 2016-2017 school year. Therefore, with the new assessment tool being the only direct change that has been made within the classroom since trimester scheduling began, it would be prudent to examine what the effect of the self-assessment tool has on student learning. This classroom activity and its impact on student self-awareness and achievement is the focus of this study.

Theoretical and Conceptual Framework

The Social Cognitive Theory (SCT) posited by Bandura (1994) explained that people learn their behaviors by observations within social settings. It has given rise to a deeper understanding of how humans develop their individual beliefs of their own capabilities to succeed. He coined the term "self-efficacy" and explained it as a person's perception of his/her own ability to accomplish difficult tasks. Specifically, self-efficacy is defined as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (Pajares & Urdan, 2006; Bandura, 1994). Self-efficacy and motivation have been instrumental in understanding the metacognitive influences that contribute to individual success. As many teachers find it increasingly difficult to motivate their students to be more autonomous with their own academic progress, studies have increasingly focused on ways to build self-efficacy and why it should be pursued in the educational setting. Bandura (1994) goes on to explain that an individual's personal self-efficacy plays a very important role in shaping his/her personality and behavioral traits, which then

directs his/her intrinsic motivational habits. These habits in turn influence a person's degree of accomplishment as it pertains to certain tasks.

Various studies have shown the value of self-efficacy as a predictor of college and career readiness (Nagaoka et al, 2013). For example, an individual that possesses a high level of self-efficacy will be more inclined to make a commitment to finish difficult tasks because he/she sees them as something to master and overcome rather than as a road block. Contrarily, an individual with low self-efficacy will have the opposite reaction to arduous tasks; seeing them as chasms that he/she cannot cross (Kirbulut, 2014; Schunk & Meece, 2006). In Paul Gore's 2006 study, *Academic Self-Efficacy as a Predictor of College Outcomes: Two Incremental Validity Studies*, (as cited in Fusch, 2012; Roos, 2012) it was determined that there was a correlation between college freshmen's GPA's and their magnitude of personal self-efficacy. Students who maintained a sense of their own ability to be successful maintained a higher GPA and were less likely to drop out. Likewise, Gore (2006) stated that there are some high school students, who despite having excellent scores and high GPA's, fail to flourish in the college environment, whereas some students with average GPA's and low scores manage to do very well in college (Fusch, 2012). Research illustrates the impact that self-efficacy mindsets have on student achievement among students of varying educational levels from middle school to college; especially in subjects that are perceived as difficult. For high school students who want to be successful in college and/or career, higher self-efficacious mindsets need to be practiced and mastered before they graduate, because as they enter into new domains post-secondarily, they will encounter unfamiliar situations, and having developed a self-efficacious mindset will help them navigate those uncharted waters more successfully.

Building a strong self-efficacious mindset in adolescents is key to building students who are more likely to achieve higher academic performance and meet set goals (Kirbulut, 2014). Bandura suggested that self-efficacy is developed over time as children mature into adults and their social-cognitive skills evolve (Schunk & Meece, 2006). The four broad activities that can help to build self-efficacy beliefs are as follows: opportunities for performance accomplishments (mastery experiences), opportunities to observe someone else similar to one's own abilities accomplishing tasks (vicarious experience), being persuaded by others to complete a task, and being able to control one's physiological state in order to maintain an optimistic outlook (Moesgaard-Kjeldsen, 2014). Research has shown that by using these strategies, adolescents are more encouraged, and as a result, stand a greater chance to build higher self-efficacy. Of the four activities that help to build self-efficacy, mastery experiences had the greatest effect with peer/mentor persuasion and vicarious experience coming in close behind (Kirbulut, 2014; Chemers, Zurbriggen, Syed, Goza, & Bearman, 2011; Dweck, Walton, & Cohen, 2014). It would seem logical that when students have positive experiences with difficult tasks and manage to master those tasks, they would begin to build the confidence they need to persist and continue growing. Over time, as a student has more and more mastery experiences and his/her confidence grows, he/she develops a mindset that is conducive to long term goal planning and persistence toward goal accomplishment.

Benjamin Bloom's concept of "mastery learning" has been studied and practiced since he first coined the phrase from his own research in 1968. He posited that if teachers break up learning goals in to small chunks or units and periodically use formative assessments to gauge the level of mastery students are achieving, then nearly all students will have an equal opportunity to master the standards being taught (Guskey, 2009). When he conducted his

research, he noticed that students who were taught using the mastery learning strategies were more likely to achieve regardless of where they started from. In order to make this work, some key instructional components must be followed. First, teachers pre-plan the standards or skills to be taught into smaller units that will make it more easily organized for student consumption. Secondly, teachers give students a pretest in order to establish a baseline for each student. After a few lessons the teacher will then give a formative assessment that will be used to measure how much progress is being made by each student. These assessments are only meant to inform teachers of students' strengths and weaknesses, and not used to assign grades for standards taught. Teachers then individualize each student's learning with corrective lessons to improve upon his/her weaknesses. After a given length of time, students will again take another formative assessment that measures how much they have learned from the corrections, and if they have mastered the learning objectives for the unit (Bloom, 1968). This cycle is continued until all students have mastered the standards being taught for the unit. Bloom's study (1968) showed that when mastery learning techniques were used, the bell curve for summative assessments within the class shifted, illustrating more A's and B's earned rather than the traditional bell curve that typically would have the majority of students scoring in the C range. Mastery experiences can occur in a variety of ways, but essentially this happens when students have the chance to experience their own accomplishments on difficult tasks or challenges (Artino, 2012). A particular strategy that can be used to build mastery experiences and self-awareness for students is self-assessment. Self-assessment techniques should encourage students to take the time to judge the quality of their own work and assess their own progress toward meeting expected goals (Hamilton, 2015; McMillan & Hearn, 2008; Nicol & Macfarlane-Dick, 2007). The key to any type of self-assessment is to make the student the center of their own

scoring and progress using well-crafted scoring guides (Dweck et al, 2014; Nicol & Macfarlane-Dick, 2007). This is necessary in order to allow students the opportunity to experience the self-acknowledgement of accomplishing difficult tasks and mastering difficult standards. The more often a student has these types of experiences, the more self-confident he/she becomes about his/her own ability to achieve, and the more resistant he/she becomes to the damaging effects that failures can have on individuals with low self-efficacy (Artino, 2012).

The concept being studied in this research pertains to the relationship between biology self-assessment scoring guides, student achievement, and self-efficacy among high school biology students in a rural, socioeconomically disadvantaged community. Within the context of other subjects, the practice of using self-assessment scoring guides has demonstrated a positive impact on student achievement and self-efficacy. For example, improving students' sense of self-efficacy using self-assessment techniques has shown to increase their achievement and self-efficacy in other subjects such as with foreign language students at the collegiate level (Coronado-Aliegro, 2006). With many high school students disengaged in the STEM subjects, and a decline of American high school students seeking to further their educational studies in the STEM program of study at the collegiate level, it is important to study techniques that may help to reverse declining interest in STEM fields. Considering the lack of motivation among high school students to be academically engaged, it is becoming increasingly important to investigate the effectiveness of self-assessment strategies to build greater self-efficacy in science students. If high schools are expected to produce more students who are college and career ready, then more research is needed to find ways to incorporate self-efficacy building strategies in the high school classroom curriculum (Adams, 2013; Nagaoka et al, 2013; Venezia & Jaeger, 2013; Sommerfeld, 2011).

Purpose of the Study

The purpose of this study was to investigate the impact that biology self-assessment scoring guides have on actual student achievement and student self-efficacy. The scoring guides are used to identify performance levels for biology standards being covered per unit of study. Students are allowed to self-assess their own performances of the biology standards in pre-test and post-test applications of the scoring guides. Previous studies have focused on the effect that self-efficacy has on student achievement within different context such as foreign language, mathematics, chemistry, and English. However, this study focused on the context of the high school biology class for students in a rural, economically disadvantaged school/community, and attempted to reveal any significance that might be present in student achievement and student self-efficacy as a result of the self-assessment practices employed in the class with the biology standards-analysis scoring guides.

Significance of the Study

The data collected from this study will add to the existing body of knowledge on the impact of self-assessment techniques and building self-efficacy in high school biology students. While similar research exists, it consists of other subjects such as foreign language, mathematics, and English. Many of the previous studies on the impact of self-assessment, self-efficacy, and student achievement were conducted at the collegiate level and a small number of studies investigated adolescent students at the middle and high school level. Therefore, this study will help augment the research perspective as it pertains to the impact of self-assessment practices on student achievement and self-efficacy in the context of high school biology students in a rural, socioeconomically-disadvantaged community. The researcher hopes to be able to generalize the findings of the study in such a way that the results can be used to encourage the use of more

student self-assessment practices within the research site in different subjects, as well as across the district within the other two high schools.

Research Questions

The participants consisted of 10th grade biology students who were enrolled in the 2016-2017 biology classes. The answers that arose from the following research questions were designed to examine the impact that the biology self-assessment, scoring guides have on student achievement and student self-efficacy within a unit of study. This study investigated the following research questions:

1. Is there a significant effect on student achievement when students use self-assessment scoring guides in biology class?
    a. H_0 = There will be no significant difference in the achievement scores of those students who used the self-scoring treatment versus those students who did not use the self-scoring treatment.
2. Is there a significant effect on student self-efficacy when students use the self-assessment scoring guides in biology class?
    a. H_0 = There will be no significant difference in the MSLQ mean scores of those students who used the self-scoring treatment versus those students who did not use the self-scoring treatment.

Limitations and Delimitations

The limitations of this study were factors that may have an impact on achievement outcomes of some students. For example, the demographic differences between students, such as socioeconomics, could impact individual self-efficacy among the participants. Individual student learning abilities can differ greatly within a specific class because the research school where the

study was conducted practices the inclusion model for classroom instruction. Therefore, the researcher only compared students of similar academic abilities in order to ensure equitable comparisons. Attendance issues caused some students to miss important treatment events, which interfered with data collection for some participants.

The delimitations of this study were factors the researcher could somewhat control. For example, the researcher administered the self-assessment scoring guides and the academic self-efficacy scale. However, the researcher did not provide the classroom instruction covering the unit of study. Although a different teacher gave the actual instruction of the content, the researcher controlled the administration of the self-efficacy survey and the self-assessment scoring guides. The teacher within the classroom being studied already has a well-established relationship with the study participants, which ensured that participants had a comfortable level of familiarity with the instructor and the research setting. The population chosen for the study was under the full control of the researcher and the teacher, and consisted of enrolled Biology I students for the 2016-2017 school year.

Definition of Terms

Academic Self-Efficacy is defined as the belief that one has in his/her ability to achieve at a designated level of achievement within a given unit of study or subject matter (McGrew, 2008).

Self-assessment refers to a technique or tool that can help a student learn to become more aware of their own progress toward learning a particular objective such that he/she makes the corrections necessary to progress (McMillan & Hearn, 2008; Nicol & Macfarlane-Dick, 2007).

Academic Hard Skills can be defined as learning skills that can be easily measured using quantitative data; such as standardized test scores, attendance, and GPA (Nagaoka et al, 2013; Venezia & Jaeger, 2013; Sommerfeld, 2011).

Academic Soft Skills can be defined as learning skills that are not easily measured by quantitative measures. Some of these skills consist of self-efficacy, self-regulation, promptness, tenacity, and motivation (Sommerfeld, 2011; Venezia & Jaeger, 2013; Nagaoka et al, 2013; Sloane, 2014; Holmes, 2014).

STEM is an acronym that means science, technology, engineering, and mathematics.

CHAPTER 2: Review of the literature

Introduction

In today's climate of public education reform, there has been a greater emphasis placed on preparing high school students to be college and/or career ready, in addition to increasing graduation rates. A 2010 report, issued jointly by the National Center for Public Policy and Higher Education and the Southern Regional Education Board (SREB) suggested a widening of the gap between high school students earning a diploma and being ready for college level course work. While the graduation rate has improved over the last decade, with more than 75% of high school students graduating with a high school diploma; 30 – 40% of these students will need remedial course work (Chapa, Galvan-De Leon, Solis, & Mundy, 2014; Sparks & Malkus, 2013). Concurrently, post-secondary enrollment over the last two decades has been steadily climbing, but college graduation rates have not increased at the same pace (Nagaoka, Farrington, Roderick, Allensworth, Keyes, Johnson, & Beechum, 2013).

College Readiness Statistics

College readiness has been broadly defined as a graduating senior's preparedness to enroll in college-level course work without being required to enroll in mathematics and/or English remedial courses at the beginning of his/her post-secondary, freshman year (Venezia & Jaeger, 2013). According to results from the National Assessment of Educational Progress (NAEP), 12th grader's scores on math and reading assessments remained stagnant in 2013, from the result in 2009; which stated that only 26% were proficient or better in math and 38% in reading (The Nation's Report Card, 2013; Venezia & Jaeger, 2013). College ready benchmarks indicate a student's chances of making a "B" or better in each on for the four tested areas of mathematics, reading, English, and science (ACT College Readiness Benchmarks, 2015).

Statistics for the graduating class of 2014 in Tennessee indicated that overall college readiness has remained below national averages over the last five years (ACT Profile Report-Tennessee, 2014).

Influence of Academic Hard Skills

Various studies have explored what factors can be attributed to college readiness. In general, these factors can be categorized into two types of skills - academic and non-academic. Some studies refer to them as "cognitive" and "non-cognitive" influences that affect college readiness and thus student success (Nagaoka et al, 2013; Venezia & Jaeger, 2013; Sommerfeld, 2011). Typical college-readiness characteristics that are more easily quantifiable are student variables such as "high school GPA, standardized test scores, and high school rank" (Sommerfeld, 2011). Other academic traits that educational studies prefer to emphasize can also be aspects of a student's transcripts that indicate the amount of rigorous coursework taken and grades achieved for those courses that could "increase academic preparation" (Nagaoka et al, 2013). These academic skills could also be referred to as hard skills because they strictly focus on academic variables that can easily be measured by standardized tests. The college and career-ready faction like to base much of their propaganda of how many high-school students are ready for post-secondary life on standardized test results from exams like the ACT (Adams, 2013). However, post-secondary schools are now beginning to base more of their admissions requirements on multiple, academic, hard skills such as ACT scores, final grades in math, science, and English courses, and writing skills as measured on end-of-year exams (Nagaoka et al, 2013; Venezia & Jaeger, 2013; Sommerfeld, 2011; Chapa et al, 2014; National Center for Public Policy and Higher Education & SREB, 2010). If these measures alone could ensure college and/or career success, then one would expect all students with noticeable hard skills to

always be successful. However, studies are beginning to show that not all high school graduates with these identifiable hard skills will in fact be successful in college.

Influence of Academic Soft Skills

While much of the college-readiness rhetoric seems to focus more heavily on the academic factors (hard skills), a growing interest in the non-academic factors is now being considered. For the purpose of this document, non-academic factors will be referred to as academic soft skills. In Paul Gore's 2006 study, *Academic Self-Efficacy as a Predictor of College Outcomes: Two Incremental Validity Studies*, (as cited in Fusch, 2012; Roos, 2012) it was determined that there was a correlation between college freshmen's GPA's and their magnitude of personal self-efficacy. Students who were cognizant of their own ability to be successful maintained a higher GPA and were less likely to drop out. Likewise, Gore stated that there are some high school students, who despite having excellent scores and high GPA's, fail to flourish in the college environment. Conversely, some students with average GPA's and low scores manage to do very well in college. That is not to say that academic hard skills are not important, but for some students, academic soft skills are just as critical (Fusch, 2012).

Soft skills are more qualitative types of student academic characteristics (non-academic, non-cognitive). For example, student variables such as time management skills, study habits, a sense of awareness of one's own abilities to succeed (self-efficacy), perseverance, tenacity, organizational skills, and collaborative/cooperative attitude (Sommerfeld, 2011; Venezia & Jaeger, 2013; Nagaoka et al, 2013; Sloane, 2014; Holmes, 2014). Some academic soft skills are not as easy to ascertain on college admission applications. For instance, being able to determine a student's study habits or collaborative/cooperative attitude might be hard to judge without an extensive interview and possibly analysis of a personality questionnaire. However, self-efficacy

has been studied for several decades, and appears to influence other soft skills. Albert Bandura has been credited with developing the Social Cognitive Theory and defining the term self-efficacy as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (Pajares & Urdan, 2006; Bandura, 1994). Bandura (1994) goes on to explain that an individual's personal self-efficacy plays a very important role in shaping his/her personality and behavioral traits, which then directs his/her intrinsic motivational habits. These habits, in turn, influence a person's degree of accomplishment as it pertains to certain tasks. For example, an individual that possesses a high level of self-efficacy will be more inclined to make a commitment to finish difficult tasks because he/she sees these tasks as something to master and overcome rather than as impediments. Contrarily, an individual with low self-efficacy will have the opposite reaction to arduous tasks; seeing them as chasms that he/she cannot cross (Kirbulut, 2014; Schunk & Meece, 2006). Several studies have linked self-efficacy to traits that prove to be beneficial to college students, such as perseverance and tenacity. Perseverance is defined as one's willingness to complete a task despite adversity and/or failure; one's willingness to not give up and to see it through until the end (Perseverance, 2015). Academic tenacity is defined as the ability to stay-the-course or continue with a positive attitude to fulfil long-term goals. Tenacious students often persist through difficult tasks and refuse to give up on the academic goals that they have set for themselves. They often believe that pursuit of deeper knowledge and higher education is an absolute endeavor that must be accomplished (Dweck, Walton, & Cohen, 2014). For high school students who want to be successful in college and/or career, the academic soft skills need to be practiced and mastered before they graduate. When these students enter into new domains post-secondarily, they will encounter unfamiliar situations, and having developed a self-efficacious

mindset will help them proceed successfully. While it may remain unclear as to the magnitude academic soft skills contribute to post-secondary success, it is evident by Bandura's research that highly self-efficacious individuals are more likely to persist and tenaciously pursue their life goals with success despite any obstacles they may encounter (Venezia & Jaeger, 2013).

Developing Self-Efficacy

According to Nagaoka et al. (2013), there are five areas that need to be considered when trying to develop lessons that encourage higher academic performance: academic behaviors, academic perseverance, social skills, learning strategies, and academic mindsets (pp. 47-49). After examining the details of these five areas that lead to greater academic performance they are all predicated on self-efficacy. Therefore, building a strong, self-efficacious mindset in adolescents is critical to influencing students who are more likely to achieve higher academic performance and meet set goals (Kirbulut, 2014). Bandura posited that self-efficacy is developed over time as children mature into adults and their social-cognitive skills evolve (Schunk & Meece, 2006). The four broad activities that can help to build self-efficacy beliefs are as follows: opportunities for performance/mastery accomplishments, opportunities to observe someone else similar to one's own abilities accomplishing tasks (vicarious experience), being persuaded by others to complete a task, and being able to control one's physiological state in order to maintain an optimistic outlook (Moesgaard-Kjeldsen, 2014). Research has shown that by using these strategies, adolescents are more encouraged, and as a result are more likely to build higher self-efficacy.

While general academic success is more likely to be observed by developing the above mentioned strategies, subject areas that are typically viewed as "harder," see the most benefit from developing self-efficacy beliefs (Kirbulut, 2014). For example, subject areas in the STEM

related courses, such as math and science, are typically avoided by many minority students because they are seen as difficult to master. Likewise, studies have shown that those students generally have lower self-efficacy within the context of those areas of study (Byars-Winston, Estrada, & Howard, 2008). Although the study participants initially possessed the same academic performance levels in math and/or science, they perceived that they were not smart enough to compete and persist, and were more likely to give up or leave the program of study prematurely (Byars-Winston, Estrada, & Howard, 2008). Therefore, it is recommended that self-efficacy building, especially in minority groups, can positively affect the outlook and perception of those students such that they are more likely to be successful in STEM programs of study (Chemers, Zurbriggen, Syed, Goza, & Bearman, 2011).

Of the four activities that help to build self-efficacy, mastery experiences had the greatest effect, with peer/mentor persuasion and vicarious experience having a slightly lesser effect (Kirbulut, 2014; Chemers et al, 2011; Dweck et al, 2014). It would seem logical that when students have positive experiences with difficult tasks and manage to master those tasks, they would begin to build the confidence they need to persist and continue growing. Over time, as students have increasing mastery experiences and their confidence grows, they develop mindsets that are conducive to long-term goal planning and persistence toward goal accomplishment. Teachers, mentors, and/or parents can help to encourage and develop this mindset by offering guided opportunities for academic success within various subject-specific domains. Research has shown that when adolescent students experience academic failures, their resiliency is dependent on whether or not the student has a high self-efficacious frame-of-mind (Dweck et al, 2014). Vocal encouragement and mastery experiences are important strategies that all teachers from every grade level should be utilizing to enhance the educational quest for their students.

Self-Assessment as a Strategy

One particular strategy that can be used to build mastery experience and self-awareness for students is self-assessment. Self-assessment techniques should encourage students to take the time to judge the quality of their own work and assess their own progress toward meeting expected goals (McMillan & Hearn, 2008; Nicol & Macfarlane-Dick, 2007). This type of assessment can take on a variety of forms, but the primary goal should be to ensure that students are making judgements about their own work based on criteria that are concrete. These judgements should help them grow their critical thinking skills, as well as provide them with a more realistic perspective of their own abilities (Ross, 2006). When students routinely self-assess, they begin to learn how to identify their own strengths and weaknesses. In turn, this helps them to build their self-awareness and it enhances their self-efficacy (McMillan and Hearn, 2008). In the process of building their self-efficacy through carefully constructed self-assessments, students generally become more motivated, and greater motivation will result in higher achievement.

In addition to modeling greater motivation and achieving at higher levels, students begin to be more proactive and less reactive about their own state of academic affairs (McMillan & Hearn, 2008; Nicol & Macfarlane-Dick, 2007). They gain insight to what they need to be doing differently in order to improve their work, whether it means they should attend after-school tutorial sessions with their teacher or simply be more participatory in classroom discussions or group activities. They become more likely to "self-advocate" (Hamilton, 2015). Once they begin to master the ability to understand their own shortcomings, they are more likely to accept constructive criticism of their work and not be discouraged by this criticism. This teaches them to be more receptive to their teacher's critiques, as well as their own, and it will assist them in

building the necessary personality traits to persist in a college and/or career environment with the positive outlook needed to continually improve the quality of their work.

Some studies have shown that quality self-assessments have improved student actions, such as disruptive behavior, time-on-task, self-management skills, and personal goal setting for the short term and the long term (Ross, 2006; Hamilton, 2015). According to McMillan and Hearn (2008), a general description was given to illustrate how the student self-assessment process is a continual cycle between self-monitoring, self-judgement, and learning targets/instructional correctives. This cycle embeds the component of self-reflection, which is a critical skill for college students. When students reflect upon the skills they have mastered and the ones they have yet to master through the evaluative process, they become better able to think about what they are learning on a deeper level (Nicol & Macfarlane-Dick, 2007). Students begin to be able to better access more of the higher-order thinking skills necessary to apply their knowledge on a more global scale, which will enable them to be more successful in future college academic tasks (McMillan & Hearn, 2008).

While self-assessment strategies have shown to boost intrinsic motivation in adolescent students, many teachers still do not use them frequently enough. Approximately 75% of teachers said they use them occasionally (Dweck et al, 2014; McMillan & Hearn, 2008). If many studies have shown the benefits of student self-assessment, then why are teachers under-utilizing them? Perceived weaknesses still exist relative to self-assessments. Teachers question the reliability of such assessments. For example, many teachers believe that their best students are overly critical of their own work and evaluate themselves more harshly than the teacher would. Other students may not be critical enough of their own work when they are obviously weak in a given area, and therefore fail to gain valuable insights that would help them improve (McMillan & Hearn, 2008).

The concern of many teachers that students would intentionally misuse the strategy in order inflate their own grades has prevented the technique from being used more often.

The self-assessment strategy can be utilized with more reliability and effectiveness if teachers take more care to develop self-assessment practices with solid structure and clear expectations. Careful design of the self-assessment tool will contribute to the tool's effectiveness to foster intrinsic motivation (Dweck et al, 2014; Nicol & Macfarlane-Dick, 2007). Teachers must first train students on how to appropriately use a self-assessment tool. McMillan and Hearn (2008) suggested that there are four overlapping areas that teachers need to pay special attention to when developing self-assessment scoring guides. First, teachers would have greater success with self-evaluative guides if they are careful to use performance language a student can easily interpret. The language needs to be clear and recognizable. The language should also be relevant to the performance standards students can relate to and should follow defined curriculum guidelines. Secondly, teachers need to model for students how to use the guides. It would be prudent to allow students to practice using the guides to score samples of student works. Next, teachers should be sure to give students multifaceted feedback. Essentially, students need to get feedback from at least three sources; teacher, self, and peer. This allows the students to more accurately measure the quality of the work done as opposed to the quantity of work done. Finally, teachers need to design criteria for students to record and revisit past performance data. Self-assessments are better utilized for the long term if students are allowed to reflect on previous academic work and compare that to their current work. This technique fosters a learning growth mentality with students so that they become more aware of how to establish and achieve proper goals (Ross, 2006; McMillan & Hearn, 2008). This allows

students to revisit their past mastery experiences, which will further construct their self-efficacious framework and extend their confidence for future challenging tasks.

Conclusion

There is no doubt that students in the 21st century and beyond will need to develop skills that allow them to think creatively, to develop a persistent work ethic, and to maintain a tenacious attitude. Future careers will require high school students to obtain some kind of post-secondary training and/or education. Without a strategically crafted K-12 educational experience, students may find it difficult to compete, and achieve the lifestyle that they desire because they will be ill-equipped to be successful in college and/or career endeavors. While research shows that hard academic skills such as content knowledge, writing skills, and logic/reasoning skills are important for post-secondary success, more data is beginning to point to other variables (referred to earlier as academic soft skills) that can be invaluable to graduating high school seniors. Academic soft skills are critical aspects of an individual's resume that will allow him/her to persist in the face of uncertainty. Additionally, many employers and colleges are evaluating the soft skills of applicants, such as organization, leadership, time management, collaborative/cooperative attitude, persistence, tenacity, and interpersonal skills.

Building an individual's self-efficacy at an early age and maintaining it has been shown to help develop the academic soft skills that will be an asset to post-secondary students. Motivation is the key factor that ultimately drives the human race. Albert Bandura said, "People's level of motivation, affective states, and actions are based more on what they believe than on what is objectively the case" (1997). Motivating young minds to think at higher cognitive levels so that teachers can facilitate creative thinking within each student is becoming a task that many teachers today are being challenged to perform more effectively. While there is a

plethora of teaching strategies being utilized daily, one particular strategy that should get more attention in today's classrooms. Allowing students to self-assess will build the self-efficacy necessary to perpetuate those soft skills that are becoming a rare commodity for today's youth. Self-assessment techniques that improve achievement need to be carefully crafted and studied to a greater extent; especially within the specific domains of math and science and with student subgroups from underrepresented student populations. America's youth are pursuing education and STEM careers less frequently, so greater attention needs to be focused on how to motivate students to become innovators. Careful design and utilization of student self-assessment practices may be a critical component in the development of intrinsic motivation in minority students. Therefore, it is logical and necessary to study the impact of self-assessment scoring guides on the learning outcomes for high school biology students in a rural, economically-disadvantaged community.

CHAPTER 3: Methodology

Methods and Procedures

Motivation is a key component for building habits that encourage student ownership of learning. Motivation is defined as a frame of mind that a person has in which he/she move toward or act upon completing goals and tasks (Usher & Kober, 2012). It is something within an individual that develops over time for various reasons, and is dependent upon context. According to Usher and Kober (2012), "40% of high school students, depending on the study, are disengaged from learning, are inattentive, exert little effort on school work, and report being bored in school. Learner motivation and self-efficacy can dictate the magnitude of a student's achievement in a post-secondary world (Bonney, Klemper, Zusho, Coppola, & Pintrich, 2005). Whether a student can persist in a difficult subject or task correlates to his/her level of self-efficacy toward academic achievement (Byars-Winston, Estrada, & Howard, 2008; Kirbulut, 2014).

According to Birdwell (2013), approximately 33% of high school students met all the benchmarks for college readiness with the least percentage of students meeting college readiness benchmarks for science. From 2013-2014 these figures improved little, with over 50% of high school students not meeting the benchmarks for college readiness (ACT College Readiness Report, 2014). College readiness has been broadly defined as a graduating senior's preparedness to enroll in college-level course work without being required to enroll in mathematics and/or English remedial courses at the beginning of his/her post-secondary, freshman year (The Nation's Report Card, 2013; Chapa, Galvan-De Leon, Solis, & Mundy, 2014; Sparks & Malkus, 2013; Venezia & Jaeger, 2013). Determining college readiness based on academic hard skills, such as ACT test scores and GPA is not sufficient enough to predict a student's level of success

in college. Other factors relating to a student's academic traits which have a significant impact on his/her college readiness include the following: organization skills, study habits, perseverance and tenacity, and self-efficacy (Sommerfeld, 2011; Venezia & Jaeger, 2013; Nagaoka, Farrington, Roderick, Allensworth, Keyes, Johnson, & Beechum, 2013; Sloane, 2014; Holmes, 2014). Research has shown that there is correlation between a student's self-efficacy and his/her level of academic achievement (Perseverance, 2015; Fusch, 2012; Roos, 2012).

This study focused on the instructional technique of using student self-assessment as a means for building self-efficacy and improving learning outcomes of high school science students. The context of this study was to evaluate the impact that self-assessment scoring guides had on high school biology students' learning outcomes and self-efficacy. With these scoring guides, students took a pretest at the beginning of a unit of study, and used the scoring guides to measure their initial level of understanding about the unit's standards (See Appendix B). Once students were approximately half way through the unit, another formative assessment was administered, and students were allowed to self-score using the same guide. Just as with the Bloom's mastery learning concept, students' were given the opportunity to correct learning errors as they moved through the unit before they received the summative post-unit test which, was counted as a test grade. Once the unit was completed and the post-unit test was graded by the teacher, students once again used the self-assessment scoring guides to measure their own progress toward meeting the biology standards, and to examine were their performance levels where at that time (See Appendix B). This allowed students the chance to see just how much they had learned over the course of the unit of study. They were provided the opportunity to chart their own learning growth each time they took the assessment during the unit of study.

Research Design

This study was conducted using a quasi-experimental design. The treatment that was studied consisted of a pre/post-test application of the self-scoring guide (See Appendix B) within the biology curriculum. The researcher allowed students to self-assess their level of performance for mastery of the biology standards within a given unit of study by using a pre-unit standardized test with the scoring guides, and once again after the unit had concluded. There was a treatment group that received the self-assessment scoring guides and a control group that did not receive those guides. The treatment did not count as a grade for the class for either the treatment group or the control group. However, the post-test scores counted as a test grade. This was necessary in order to hold students accountable for their own results. The Tennessee Item Sampler practice test for the Flow of Matter and Energy unit of study was utilized to measure student achievement differences between the treatment group and the control group. The paired t-test was used to investigate the difference in pre/post-test achievement scores for both the treatment group and control group. The independent t-test was utilized to examine the post-test, mean achievement scores between the treatment group and the control group for any significant difference in the groups' post-test, mean scores. This was necessary in order to investigate any significant differences in students' mean post-unit achievement scores between those students who received the treatment and those who did not receive the treatment.

In addition, a pre/post-test application of the Motivated Strategies for Learning Questionnaire (MSLQ): self-efficacy subscale, was given to both the control group and the treatment group (Pintrich & De Groot, 1990). The results of paired t-tests were examined to investigate the effect of the self-scoring guides on students' self-efficacy pre-unit versus post-unit for the treatment group and the control group. The mean self-efficacy scores for each group

were described both in narrative form and tabular form within this document. A comparison between the pre and post-unit mean scores within each group was examined to identify the level of impact that the self-assessment scoring guides had on biology students' self-efficacy. In addition to the quantitative data analysis provided in this study, histogram charts were provided to show the difference in student responses for each of the nine MSLQ questions as a pre versus post response graph for each question.

Research Participants

The research participants consisted of all the students who were enrolled in the Biology I class. There was a total of seventy-three students who participated in this study for the 2016-2017 school year. Students were divided into two separate groups. The control group consisted of twenty-eight students enrolled in the same class together and separated from the treatment group. The treatment group consisted of forty-five students. These students received the self-scoring guides (the treatment). The Tennessee Item Sampler practice test results were compared between the control group and the treatment group to identify the level of impact that the self-scoring guides had on student achievement. In addition, both the control group and the treatment group received the MSLQ before the unit was started and once more after the unit had concluded and the results were examined.

Research Setting

The research school is located in a rural and economically-disadvantaged community in Southeast Tennessee. The community was once a thriving coal-mining town, but it no longer has that industry. Most parents commute for over an hour in order to work. The school had a total of 385 students enrolled in grades 9-12. The school had 25 professional teachers, one guidance

counselor, one assistant principal, and one principal. Two biology teachers and 73 students participated in the study. The graduation rate in the 2015-2016 school year was 75%.

Description of Instruments

In order to better understand the impact that student self-assessment had on student achievement and self-efficacy, the researcher previously developed specific protocols. The researcher developed a student self-scoring guide for biology class that students used to track their own level of achievement and academic growth toward mastering Biology I standards (See Appendix B). The researcher was interested in determining if those self-scoring guides had any statistically significant impact on biology students' achievement and self-efficacy. The self-scoring guide instrument was the treatment that was being studied and this treatment was provided to a sample population of Biology I students during the 2016-2017 school year. The instrument was not given to the control group. In the treatment group, the treatment was administered up to four times; before and after the unit being studied in class, and twice more as the unit progressed in intervals of once per week. The Tennessee Biology I Item Sampler practice test for the Flow of Matter and Energy unit was used to collect mean achievement scores between both the treatment group and the control group. Each groups' raw scores were recorded in an Excel spreadsheet.

In addition to the treatment tool, the participants were given the *Self-Efficacy subscale: Motivated Strategies for Learning Questionnaire: Self-efficacy Subscale,* which had been used in many other studies and was studied for validity and reliability by Paul Pintrich and Elisabeth De Groot in 1990 (See Appendix A). The MSLQ subscale consists of nine questions on a 7-point Likert scale that are designed to address student self-efficacy within a given area of study. Each question is rated on a scale of 1-7 with 1 being equal to "not at all true of me" and 7 being equal

to "very true of me". The mean scores for each group were calculated both on the pre-unit and the post-unit questionnaires. The results of this instrument were analyzed using the paired t-test in order to examine the level of significance between the pre-unit and post-unit responses for the treatment group and the control group separately. Each groups' t-test results were described in narrative and tabular form within chapter four of this document. In addition to individual group paired t-test analysis, an independent t-test was used to identify any significant difference in the post-unit responses between the treatment group and the control group. Also, an F-test was used in order to determine which independent t-test should be used, assuming unequal variance or assuming equal variance. This was necessary in order to determine whether there was a significant difference in the groups' MSLQ mean scores (treatment vs. control) after the treatment had concluded.

Pilot Study

The MSLQ subscale of self-efficacy was used for this study and had been previously used in former studies. The *Self-Efficacy subscale: Motivated Strategies for Learning Questionnaire (MSLQ),* which was used in a study that examined 7th graders in English and science classrooms investigated the correlation between student performance and five areas of motivation (Pintrich & De Groot, 1990). While the original MSLQ consisted of 81 questions that cover motivation and learning strategies, the Pintrich and De Groot study (1990) shortened the MSLQ in order to test the validity and reliability of a smaller number of questions addressing students' areas of motivation: task value, self-efficacy, test anxiety, self-regulation and cognitive strategy use. Of these five subscales, self-efficacy was the one deemed most appropriate for this study.

The version of the MSLQ used in the Pintrich and De Groot study (1990) showed a reliability $\alpha = .89$ for self-efficacy, an intrinsic value $\alpha = .89$, a test anxiety $\alpha = .75$, a cognitive use $\alpha = .83$, and a self-regulation $\alpha = .74$. The reliability for the questions concerning self-efficacy showed the strongest correlation for predicting student achievement outcomes. A free copy of the questionnaire was retrieved from the strivetogether.org website, which curates various vetted questionnaires and surveys for use in research.

Data Collection Procedures

The data collection process for the MSLQ self-efficacy responses were number coded in order to protect student privacy rights. All students enrolled in biology received this questionnaire twice. The treatment group received the instrument before the use of the self-assessment scoring guides (treatment) and then after their use once the unit of study had concluded. The control group also received the MSLQ self-efficacy questionnaire at the same time as the treatment group in the same frequency, but this group did not receive the self-assessment scoring guide treatment. The responses for each group were analyzed for significance of variation of the mean scores between each groups' pre-unit and post-unit responses. In addition, the post-unit scores on the MSLQ between the treatment group and the control group were collected and analyzed.

Finally, the Tennessee Biology Item Sampler test covering the Flow of Matter and Energy unit was utilized to record performance levels for both groups, and a comparison of their performance on the state's Item Sampler practice test was analyzed for significance in variation between the control group and the treatment group. It was also analyzed for significance in variation between pre-test scores and post-test scores for each group. Each study participant received a data folder that stored all raw data in chronological order. The treatment was utilized

four times during the course of the unit, and each time students completed the assessment tool they were allowed to self-score. The control group also used the assessment tool twice but did not self-score during the course of the unit being taught.

Data Analysis

Data was analyzed quantitatively and Excel's data analysis tool was used to perform statistical tests on the raw data collected. For the academic self-efficacy questionnaire (MSLQ), students' overall mean scores were calculated and recorded for both the pre-unit administration and the post-unit administration of the questionnaire. The statistical test that was employed to analyze the level of impact the self-scoring guides had on self-efficacy consisted of the paired t-test for each group's mean scores; pre/post unit. The purpose for using the paired t-test was to determine if there was a meaningful difference in each group's mean self-efficacy scores from pre-unit to post-unit. Also, an independent t-test was utilized to examine if there was a significant difference in the post-unit responses between the treatment group and the control group. The paired t-test data for each groups' pre-unit and post-unit responses as well as the independent t-test data which examined the difference in post mean scores between the treatment group and the control group are presented in chapter four. The data for the paired t-test and the independent t-test is represented in tabular form. In addition, descriptive data in the form of histogram graphs are provided as part of the analysis for each of the nine MSLQ questions.

In order to determine the level of significance of the mean achievement scores of the treatment group and the control group on the Item Sampler practice test, two different t-test were utilized. The mean achievement scores for the pre-test and the post-test for each group were analyzed using the paired t-test. In addition, the independent t-test was used to determine the level of significance between the treatment group's post-test scores and the control group's post-

test scores. The results of the t-tests were examined to determine if there is a significant difference in the mean achievement scores, and the MSLQ mean scores of those students who got to use the self-scoring guides versus those students what did not use the self-scoring guides. The reason for the use of the t-tests is to determine whether the differences that occurred, if any, were due to random chance or if the mean achievement scores were statistically significant despite the small sample size of enrolled biology students at the high school.

Ethical Concerns

Confidentiality procedures were incorporated to protect student privacy. Each student was assigned an achievement portfolio in which he/she filed away each self-assessment scoring guide after each use. These portfolios were securely locked up within the classroom using cabinets only the researcher could access. Each time students were given the self-scoring guides, the researcher was present to ensure that procedures were followed as designed. The portfolios were number coded for anonymity. Before the treatment began, a letter explaining the purpose of the study was sent home for the parent(s)/guardian(s) of each student to read and sign which granted parental consent for children to participate in the study. IRB permission was granted by Carson-Newman University (2016, December). Per district protocol, permission to conduct the study at the research school was obtained from the principal and the director of schools.

Chapter 4: Findings

Data Analysis

The purpose of this study was to investigate the impact of self-scoring guides on students' achievement and self-efficacy in a unit of study for a rural high school biology course. Students who participated in this study consisted of tenth graders enrolled in biology class for the 2016-2017 school year. This consisted of seventy-three students divided between two groups; treatment and control. The treatment group had a total of forty-five students and the control group had twenty-eight students. The treatment group received the self-scoring guides (See Appendix B) as the treatment in question for a total of four times during the Flow of Matter and Energy unit of study. The control group did not receive this treatment. However, both groups were given a pre-unit assessment to record benchmark scores. The assessment that was utilized was the Tennessee Item Sampler covering the Flow of Matter and Energy standards, which was available from the Tennessee Department of Education website. This assessment contained twenty-six questions covering the topic, and both the treatment group and the control group used the same assessment. In addition to a pre-test, both groups also completed the same assessment once the unit had concluded. Each groups' achievement scores where once again recorded. The only difference was that the control group did not participate in the self-scoring practice (treatment). Scores for each group were recorded for analysis using a paired t-test for each group and an independent t-test between the two groups' post-test achievement scores.

Student Achievement Data

The paired t-test for each groups' pre-test versus post-test scores was employed to determine if there was a significant difference in pre-test versus post-test scores for each group. Further, an independent t-test between the treatment groups' post-test achievement scores and the

control groups' post-test achievement scores was analyzed to determine if there was a significant difference between the two groups' post-test scores. This was necessary in order to address the first research question of this study:

1. Is there a significant effect on student achievement when students use self-assessment scoring guides in biology class?
    a. H_0 = There will be no significant difference in the achievement scores of those students who used the self-scoring treatment versus those students who did not use the self-scoring treatment.

The first research question stated above explored the impact that the self-assessment self-scoring guide (See Appendix B) had on students in a rural, economically disadvantaged high school who were enrolled in a first year biology class. This was a relevant research question in order to determine if the practice of allowing students, in such a setting, to self-score their level of achievement on the Tennessee Biology standards had an impact on student achievement. In this chapter the results of paired t-tests for each group and an independent t-test between the two groups was discussed in narrative, tabular, and graphical form.

For the treatment group the paired t-test analyzing the difference in pre-test versus post-test achievement scores were given in Table 4.1 below. The post-test mean achievement scores for the treatment group ($M = 19.43$, $SD = 3.73$) were greater than the pre-test achievement scores ($M = 11.79$, $SD = 3.43$) which resulted in a paired t-test result of $t(44) = 16.69$, $p < 0.001$ (two-tailed). Based on both the t-stat value being much higher than the t-critical value and the p-value being much less than an $\alpha = 0.01$, the H_0 was rejected. Therefore, there was a significant difference between the treatment groups' pre-test achievement scores and their post-test achievement scores.

Table 4.1

Treatment Group Achievement Scores

t-Test: Paired Two Sample for Means		
	Post-test	*Pre-test*
Mean	19.431818	8.7955
Variance	14.251057	11.794
Observations	45	45
Pearson Correlation	0.3155021	
Hypothesized Mean Difference	0	
df	44	
t Stat	16.692513	
P(T<=t) two-tail	2.106E-20	
t Critical two-tail	2.0166922	

For the control group the paired t-test analyzing the difference in pre-test versus post-test achievement scores are given in Table 4.2 below. The post-test mean achievement scores for the control group (M = 13.68, SD = 3.80) were greater than the pre-test achievement scores (M = 8.04, SD = 3.32) which resulted in a paired t-test result of $t(27) = 9.58$, $p < 0.001$ (two-tailed). Based on both the t-stat value being higher than the t-critical value and the p-value being less than an $\alpha = 0.01$, the H_0 was rejected. Therefore, there was a significant difference between the control groups' pre-test achievement scores and their post-test achievement scores.

Table 4.2

Control Group Achievement Scores

t-Test: Paired Two Sample for Means		
	Post-Test	*Pre-Test*
Mean	13.679	8.0357
Variance	14.893	10.554
Observations	28	28
Pearson Correlation	0.6272	
Hypothesized Mean Difference	0	
df	27	

t Stat	9.5775
P(T<=t) two-tail	4E-10
t Critical two-tail	2.0518

Although there was a significant difference in the post-test achievement scores of both the treatment group and the control group, the treatment groups' post-test achievement scores (M = 19.43, SD = 3.73) were much higher than the control groups' post-test achievement scores (M = 13.68, SD = 3.80). In order to analyze whether the difference in the post-test scores between the treatment group and the control group was significant the researcher used an independent t-test assuming equal variance to examine the difference in post-test scores between the two groups. The purpose for using the independent t-test assuming equal variance was based on the F-test to determine if the variances between the two groups where equal despite the sample size difference. According to the F-test results (F=1.03), the variance between the two groups was equal. Therefore, the independent t-test assuming equal variances was utilized and illustrated in Table 4.3 below. The post-test mean achievement scores for the treatment group (M = 19.44, SD = 3.73) were greater than the post-test achievement scores for the control group (M = 8.04, SD = 3.32) which resulted in an independent t-test assuming equal variance of $t(72) = 6.39$, $p < 0.001$ (two-tailed). Based on both the t-stat value being higher than the t-critical value and the p-value being less than an $\alpha = 0.01$, the H_0 was rejected. Therefore, there was a significant difference between the treatment groups' post-test achievement scores and the control groups' post-test achievement scores.

Table 4.3

Treatment Group Post-test Mean Scores versus Control Group Post-test Mean Scores

t-Test: Two-Sample Assuming Equal Variances		
	TG Post-Test	*CG Post-Test*
Mean	19.444	13.724
Variance	13.934	14.421
Observations	45	28
Pooled Variance	14.124	
Hypothesized Mean Difference	0	
df	72	
t Stat	6.392	
P(T<=t) two-tail	1E-08	
t Critical two-tail	1.9935	

From a qualitative perspective, the differences between the treatment groups' pre-test and post-test achievement scores as compared to the control groups' pre-test and post-test achievement scores were of interest. As illustrated in Figure 4.1 below, the treatment groups' average pre-test score (34% of the items correct) was similar to the control groups' average pre-test score (31% of the items correct). However, there was a large difference between the two groups' average post-test scores. The treatment groups' average post-test score (75% of the items correct) was much higher than the control groups' average post-test scores (52% of the items correct).

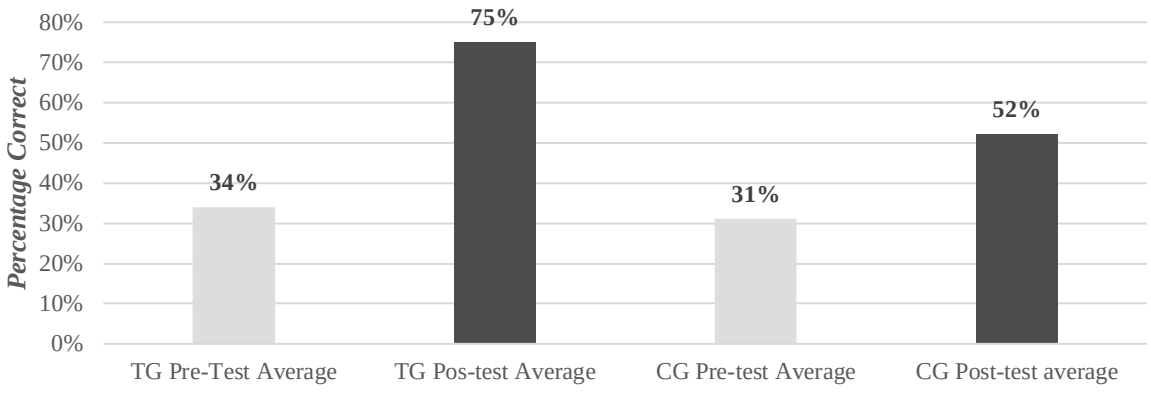

Figure 4.1 compares the average achievement growth between the pre-test and the post-test of the Treatment Group and the Control Group

When calculated, the treatment groups' average score growth was 41% more items correct after the treatment had concluded than the control group which had a growth of 21% more items correct. Once again, the control group did not receive the treatment (See Appendix B). When analyzing the qualitative data, the treatment groups' average score growth was double that of the control groups' average growth scores.

Self-Efficacy Quantitative Data

The second research question for this study was to investigate the impact that the self-scoring guides (treatment) had on students' self-efficacy.

2. Is there a significant effect on student self-efficacy when students use the self-assessment scoring guides in biology class?
    a. H_0 = There will be no significant difference in the MSLQ mean scores of those students who used the self-scoring treatment versus those students who did not use the self-scoring treatment.

In order to measure the impact, this study utilized the self-efficacy subscale, Table 4.4 below, from the MSLQ, which had been previously used in the Pintrich and De Groot (1990) study.

Table 4.4

MSLQ Self-Efficacy Subscale Items

	Not at all true of me 1	2	3	Somewhat true of me 4	5	6	Very true of me 7
1. Compared with other students in this class I expect to do well.	1	2	3	4	5	6	7
2. I'm certain I can understand the ideas taught in this course.	1	2	3	4	5	6	7
3. I expect to do very well in this class.	1	2	3	4	5	6	7
4. Compared with others in this class, I think I'm a good student.	1	2	3	4	5	6	7
5. I am sure I can do an excellent job on the problems and tasks assigned for this class.	1	2	3	4	5	6	7
6. I think I will receive a good grade in this class.	1	2	3	4	5	6	7
7. My study skills are excellent compared with others in this class.	1	2	3	4	5	6	7
8. Compared with other students in this class I think I know a great deal about the subject.	1	2	3	4	5	6	7
9. I know that I will be able to learn the material for this class.	1	2	3	4	5	6	7

The questionnaire consisted of nine questions on a seven-point Likert scale. Each student who participated in this study completed the questionnaire twice in a pre-unit/post-unit format. The nine questions illustrated above were rated on a scale of one to seven with one being "not at all true of me" and seven being "very true of me". The mean total score for each student was calculated and recorded in an Excel spreadsheet for analysis using paired t-tests for each groups' pre-unit versus post-unit analysis and an independent t-test between the treatment groups' post-unit response scores versus the control groups' post-unit response scores.

The treatment groups' pre-unit MSLQ score (M = 5.12, SD = 1.08) was compared to the treatment groups' post-unit MSLQ score (M = 5.73, SD = 0.94) using a paired t-test to determine if the difference was significant. The results of the t-test were $t(44) = 4.37$, $p < 0.001$ (two-tailed). Based on both the t-stat value being higher than the t-critical value and the p-value being less than an $\alpha = 0.01$, the H_0 was rejected. Therefore, there was a significant difference between the treatment groups' pre-test MSLQ scores and their post-test MSLQ scores. The complete results of the paired t-test were listed in the table below.

Table 4.5

Treatment Group MSLQ for Self-Efficacy

t-Test: Paired Two Sample for Means		
	Post-Unit	*Pre-Unit*
Mean	5.7313333	5.1247
Variance	0.8789073	1.1603
Observations	45	45
Pearson Correlation	0.5809515	
Hypothesized Mean Difference	0	
Df	44	
t Stat	4.3735138	
P(T<=t) two-tail	7.389E-05	
t Critical two-tail	2.0153676	

Next, the control groups' pre-unit MSLQ score (M = 4.24, SD = 1.09) was analyzed in comparison to the control groups' post-unit MSLQ score (M = 4.37, SD = 1.06) using a paired t-test to. Per the paired t-test analysis for the control groups' pre-unit MSLQ scores versus post-unit MSLQ scores $t(27) = 0.60$, $p = 0.55$ (two-tailed), the H_0 was not rejected as stated earlier with the second research question. The t-value in this comparison was less than the t-critical value necessary to reject the null hypothesis. Furthermore, the p-value was larger than $\alpha = 0.01$. Therefore, there was no significant difference in the control groups' MSLQ scores from pre-unit

to post-unit administration. This suggested that the control groups' self-efficacy was not impacted during the unit of study. Even the variance within the scores from the pre-unit MSLQ scores (1.18) to the post-unit MSLQ scores (1.12) was miniscule. This demonstrated that students' self-efficacy within the control group experienced no improvement from pre-unit to post-unit administration of the MSLQ. The complete results of the paired t-test were listed in the table below.

Table 4.6

Control Group MSLQ for Self-Efficacy

t-Test: Paired Two Sample for Means		
	Post-Unit	*Pre-Unit*
Mean	4.3714	4.241
Variance	1.1204	1.1865
Observations	28	28
Pearson Correlation	0.4117	
Hypothesized Mean Difference	0	
Df	27	
t Stat	0.6024	
P(T<=t) two-tail	0.5517	
t Critical two-tail	2.0484	

In order to conclude that the self-scoring guides (See Appendix B) had an impact on study participants, an independent t-test comparing the post-unit MSLQ scores between the treatment group and the control group was necessary. Once again the independent t-test assuming equal variances was chosen after an F-test (F = 1.27) concluded that the variances between the post-unit MSLQ scores of the treatment group and the control group were equal. The post-unit MSLQ scores for the treatment group (M = 5.73, SD = 0.94) were greater than the post-unit MSLQ scores for the control group (M = 4.37, SD = 1.06) which resulted in an independent t-test assuming equal variance of $t(72) = 5.79$, $p < 0.001$ (two-tailed). Based on both the t-stat value being higher than the t-critical value and the p-value being less than an $\alpha =$

0.01, the H_0 was rejected. Therefore, there was a significant difference between the treatment groups' post-unit MSLQ scores and the control groups' post-unit MSLQ scores. Table 4.7 below list the complete results of the independent t-test used to analyze the post-unit MSLQ scores between the treatment group and the control group.

Table 4.7

Treatment Group Post-Unit MSLQ Scores vs. Control Group Post-Unit MSLQ Scores

t-Test: Two-Sample Assuming Equal Variances		
	TG Post-unit MSLQ	*CG Post-Unit MSLQ*
Mean	5.731333333	4.37137931
Variance	0.878907273	1.12044803
Observations	45	29
Pooled Variance	0.972839789	
Hypothesized Mean Difference	0	
Df	72	
t Stat	5.790191928	
P(T<=t) two-tail	1.70575E-07	
t Critical two-tail	1.993463567	

Self-Efficacy Qualitative Data

In addition to the quantitative data discussed above concerning student self-efficacy as evidenced by the MSLQ results, the researcher included some qualitative data on student responses. The following table and histograms were provided in order to construct a detailed analysis of student responses to each of the nine questions on the MSLQ instrument. The first group of figures and tables represented the MSLQ responses from the treatment group which consisted of 45 participants. The second set of figures and table represented the MSLQ responses from the control group which consisted of 28 participants.

Treatment Group. First, Table 4.8 described the frequency of ranking value that was chosen by students within the treatment group for each question; both before the treatment and

after the treatment. This data demonstrated that the treatment groups' responses trended more toward the middle to upper end of the scale; both for the pre-unit responses and the post-unit responses. In addition, the post-unit responses were generally higher than the pre-unit responses for all questions.

Table 4.8

Treatment Group MSLQ Pre-Unit VS. Post-Unit Responses

Questionnaire Item	Not at all true of me								Somewhat true of me				Very true of me	
	1		2		3		4		5		6		7	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1. Compared with other students in this class I expect to do well.	0%	0%	4%	0%	4%	0%	18%	16%	27%	24%	27%	22%	20%	38%
2. I'm certain I can understand the ideas taught in this course.	0%	0%	2%	0%	9%	0%	18%	18%	22%	9%	36%	40%	13%	33%
3. I expect to do very well in this class.	0%	0%	2%	0%	7%	0%	7%	11%	16%	11%	27%	20%	42%	58%
4. Compared with others in this class, I think I'm a good student.	2%	0%	4%	0%	9%	0%	16%	13%	33%	11%	16%	40%	20%	36%
5. I am sure I can do an excellent job on the problems and tasks assigned for this class.	0%	0%	7%	0%	4%	2%	18%	11%	27%	27%	27%	27%	16%	33%

6. I think I will receive a good grade in this class.	0%	0%	7%	2%	0%	0%	9%	13%	24%	9%	33%	27%	27%	49%
7. My study skills are excellent compared with others in this class.	7%	2%	13%	7%	16%	7%	31%	29%	16%	20%	13%	20%	4%	16%
8. Compared with other students in this class I think I know a great deal about the subject.	7%	0%	9%	0%	4%	7%	29%	22%	22%	33%	18%	24%	11%	13%
9. I know that I will be able to learn the material for this class.	0%	0%	2%	0%	2%	0%	24%	9%	18%	18%	31%	24%	22%	49%

While the table above shows how participants in the treatment group ranked each question on the MSLQ Likert scale both times that it was administered, the magnitude of growth between the pre-unit responses and the post-unit responses of the treatment group were better visualized by histograms.

The following group of histograms represented the responses in the table above with more clarity when considering the impact that the self-scoring guide (See Appendix B) had on student self-efficacy for the treatment group. While the response data for each of the nine questions created nine histograms, the figures were condensed into three graphs consisting of three questions per graph. This created three groups of histograms: Figure 4.2 represented the treatment groups' responses to the first three MSLQ questionnaire items, Figure 4.3 represented the treatment groups' responses to the MSLQ questionnaire items four through six, and Figure 4.4 represented the treatment groups' responses to the last three MSLQ questionnaire items.

The first histogram in the following series of charts illustrated the frequency of rankings within the treatment groups' data for MSLQ items one through three. The bars in Figure 4.2 represented the frequency of responses for the treatment groups' pre-unit and post-unit questionnaire items; one through three. The first three items on the MSLQ were:

1. Compared with other students in this class I expect to do well.
2. I'm certain I can understand the ideas taught in this course.
3. I expect to do very well in this class.

In general, the treatment groups' self-efficacy ratings for MSLQ items one through three in Figure 4.2 clustered more toward the upper end of the Likert scale. When comparing the treatment groups' responses between pre-unit and post-unit administration of the MSLQ instrument, many students rated their self-efficacy higher on the post-unit instrument than they did on the pre-unit instrument.

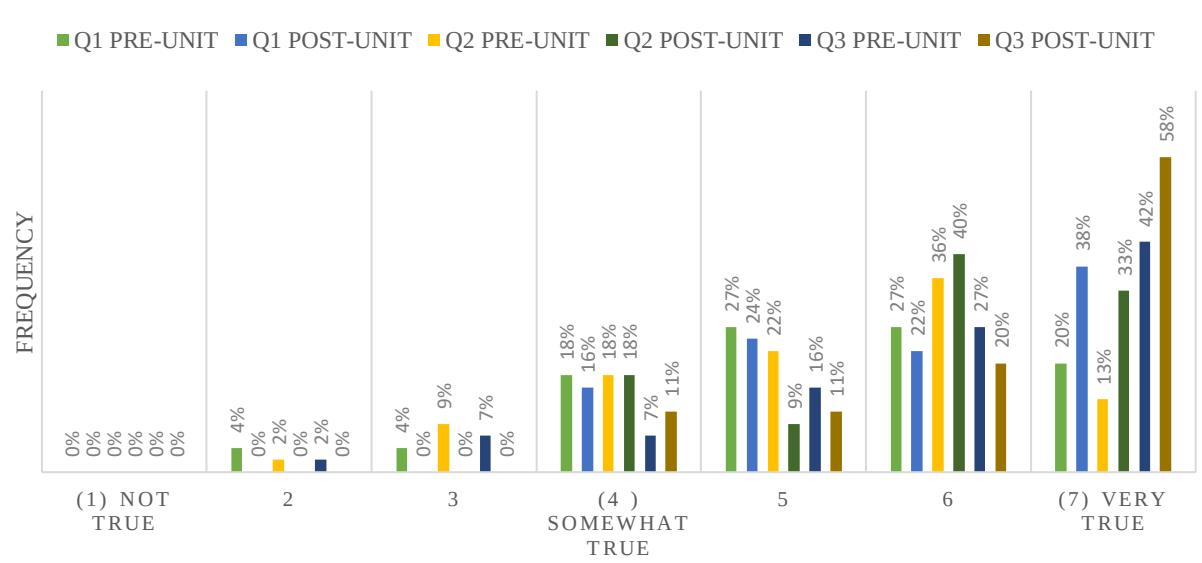

Figure 4.2 exhibits the frequency differences between the pre-unit and post-unit responses of questions 1-3 of the treatment group.

Figure 4.3 below illustrates and compares students' responses on MSLQ items four through six. The bars in Figure 4.3 represented the frequency of responses for the treatment groups' pre-unit and post-unit questionnaire items; four through six. Items four through six on the MSLQ were restated below:

4. Compared with others in this class, I think I'm a good student.

5. I am sure I can do an excellent job on the problems and tasks assigned for this class.

6. I think I will receive a good grade in this class.

The treatment groups' self-efficacy ratings for MSLQ items four through six in Figure 4.3 clustered more toward the middle-upper end of the Likert scale. When comparing the treatment groups' responses between pre-unit and post-unit administration of the MSLQ instrument, many students rated their self-efficacy higher on the post-unit instrument than they did on the pre-unit instrument.

FIGURE 4.3. TREATMENT GROUP MSLQ RESPONSES FOR ITEMS 4-6

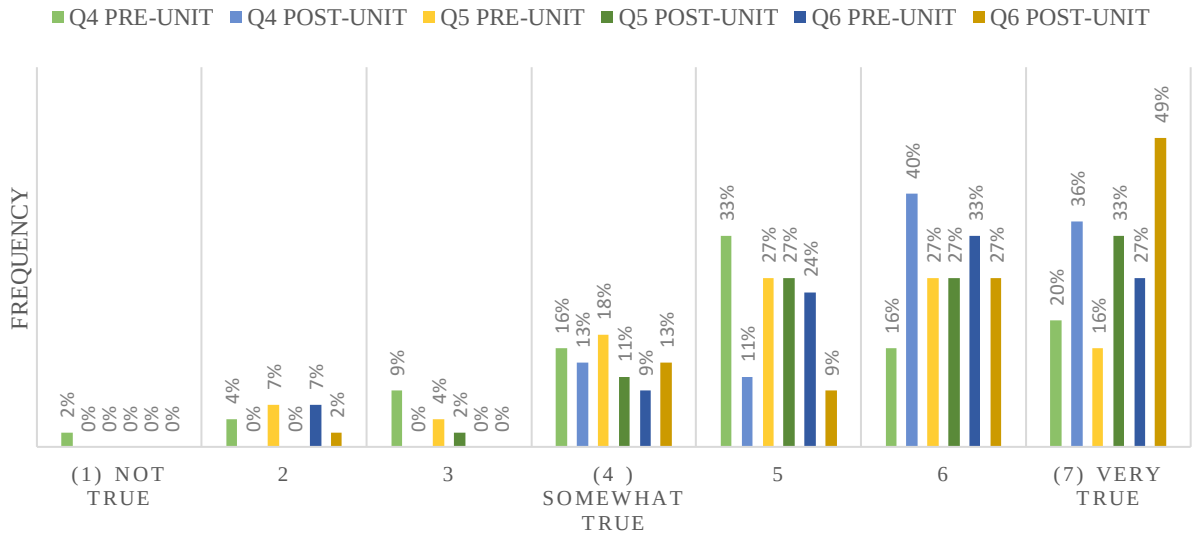

Figure 4.3 exhibits the frequency differences between the pre-unit and post-unit responses of questions 4-6 of the treatment group.

Figure 4.4 below represented the treatment groups' responses on MSLQ items seven through nine. These items were:

7. My study skills are excellent compared with others in this class.

8. Compared with other students in this class I think I know a great deal about the subject.

9. I know that I will be able to learn the material for this class.

When the data points were examined for this set of MSLQ items it was apparent that the largest jump in self-efficacy scores from pre-unit to post-unit for the treatment group occurred with item nine. On the post-unit administration of the MSLQ instrument 49% of the respondents ranked item nine, "I know that I will be able to learn the material for this class", as "very true of me (7)". In contrast, the largest frequency of students' pre-unit responses for item nine was 31% of the respondents ranking the item a six.

FIGURE 4.4. TREATMENT GROUP MSLQ RESPONSES FOR ITEMS 7-9

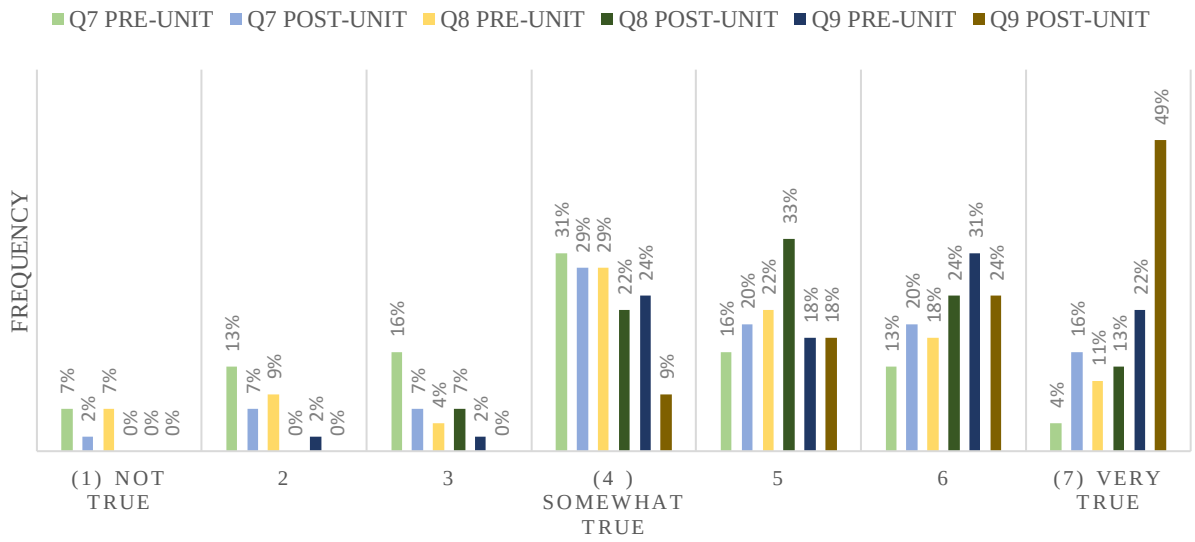

Figure 4.4 exhibits the differences between the pre-unit and post-unit responses for questions 7-9 of the treatment gourp

Control Group. The second set of histograms and table represented the MSLQ responses for the control group. Table 4.9 described the frequency of ranking value that was chosen by students within the control group for each question; before the unit was taught and after the unit concluded. This data demonstrated that the control groups' responses trended more toward the middle of the scale; both for the pre-unit responses and the post-unit responses. While the following response results indicated a similar pre-unit trend toward the middle of the scale as the treatment group, the difference in the control groups' post-unit responses were not as dramatic.

Table 4.9

Control Group MSLQ Pre-Unit VS. Post-Unit Responses

Questionnaire Item	Not at all true of me						Somewhat true of me						Very true of me	
	1		2		3		4		5		6		7	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1. Compared with other students in this class I expect to do well.	3%	0%	3%	0%	10%	10%	48%	34%	21%	38%	7%	10%	7%	7%
2. I'm certain I can understand the ideas taught in this course.	3%	3%	7%	3%	7%	17%	45%	31%	17%	14%	10%	21%	10%	10%
3. I expect to do very well in this class.	0%	0%	3%	0%	14%	17%	41%	24%	3%	34%	7%	14%	31%	10%
4. Compared with others in this class, I think I'm a good student.	7%	3%	3%	3%	14%	17%	31%	14%	10%	28%	24%	28%	10%	7%

5. I am sure I can do an excellent job on the problems and tasks assigned for this class.	3%	0%	0%	3%	10%	14%	52%	34%	14%	21%	17%	24%	3%	3%
6. I think I will receive a good grade in this class.	3%	7%	7%	3%	14%	10%	28%	21%	17%	34%	28%	24%	3%	0%
7. My study skills are excellent compared with others in this class.	17%	17%	7%	10%	17%	17%	34%	34%	14%	10%	7%	10%	3%	0%
8. Compared with other students in this class I think I know a great deal about the subject.	7%	7%	7%	7%	17%	14%	34%	38%	21%	14%	14%	17%	0%	3%
9. I know that I will be able to learn the material for this class.	0%	0%	7%	7%	3%	14%	34%	28%	24%	17%	24%	21%	7%	14%

While the table above shows how participants in the control group ranked each question on the MSLQ Likert scale both times that it was administered, the growth between the pre-unit responses and the post-unit responses of the control group were better visualized by histograms.

The following group of histograms represented the responses in the table above with more clarity when considering the impact that the self-scoring guide (See Appendix B) had on student self-efficacy for the control group. Each of the nine questions created nine histograms and those figures were condensed into groups of three questions per graph. Figure 4.5 represented the control groups' responses to the first three MSLQ questionnaire items. Figure

4.6 represented the control groups' responses to MSLQ questionnaire items four through six. Lastly, Figure 4.7 represented the control groups' responses to the last three MSLQ questionnaire items.

The bars in this Figure 4.5 represented the frequency of responses for the control groups' pre-unit and post-unit questionnaire items one through three. Items one through three on the MSLQ were restated below:

1. Compared with other students in this class I expect to do well.
2. I'm certain I can understand the ideas taught in this course.
3. I expect to do very well in this class.

As compared to the treatment groups' responses in Figure 4.2, the control groups' responses for MSLQ items one through three are more heavily weighted toward the middle of the scale; even after the unit had concluded. Based on Figure 4.5 below, the control groups' general sense of self-efficacy as it relates to MSLQ items one through three did not illustrate an increase between pre-unit and post-unit responses and many of them actually declined in self-efficacy ratings. For example, the MSLQ item responses for items one through three clustered at a 4 (somewhat true of me), and when comparing the pre-unit response rate to the post-unit response rate for each of the items many students lowered their self-efficacy score on the post-unit administration of the MSLQ instrument.

FIGURE 4.5. CONTROL GROUP MSLQ RESPONSES FOR ITEMS 1-3

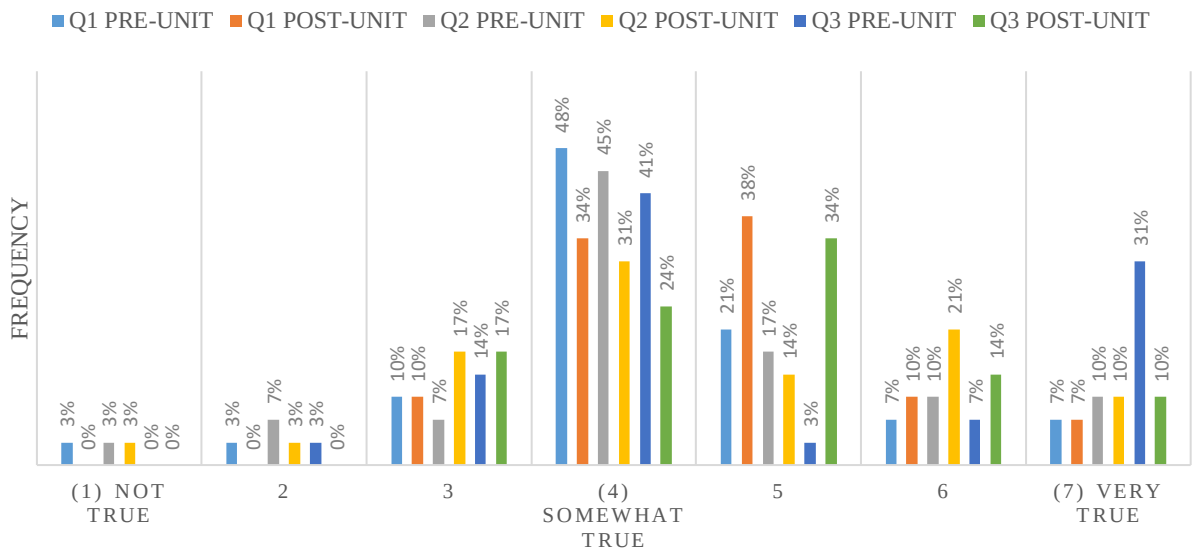

Figure 4.5 exhibits the frequency differences between the pre-unit and post-unit responses for questions 1-3 of the control group

Figure 4.6 below illustrates and compares students' responses on MSLQ items four through six. The bars in this figure represented the frequency of responses for the control groups' pre-unit and post-unit questionnaire items; four through six. Items four through six illustrated on figure 4.6 are stated below:

4. Compared with others in this class, I think I'm a good student.
5. I am sure I can do an excellent job on the problems and tasks assigned for this class.
6. I think I will receive a good grade in this class.

As compared to the treatment groups' responses in figure two, the control groups' responses for MSLQ items four through six are more heavily weighted toward the middle of the scale; even after the unit had concluded. Based on figure 4.6 below, the control groups' self-efficacy as it relates to MSLQ items four through six did not illustrate much of an increase between pre-unit and post-unit responses when compared to the treatment groups' results (Figure 4.3). There

appeared to be many more students in the control group who would not rate themselves on the upper end of the MSLQ scale for items four through six as compared to the treatment group. In addition, there was a greater frequency of students in the control group that ranked their self-efficacy on the lower end of the scale than did the treatment group.

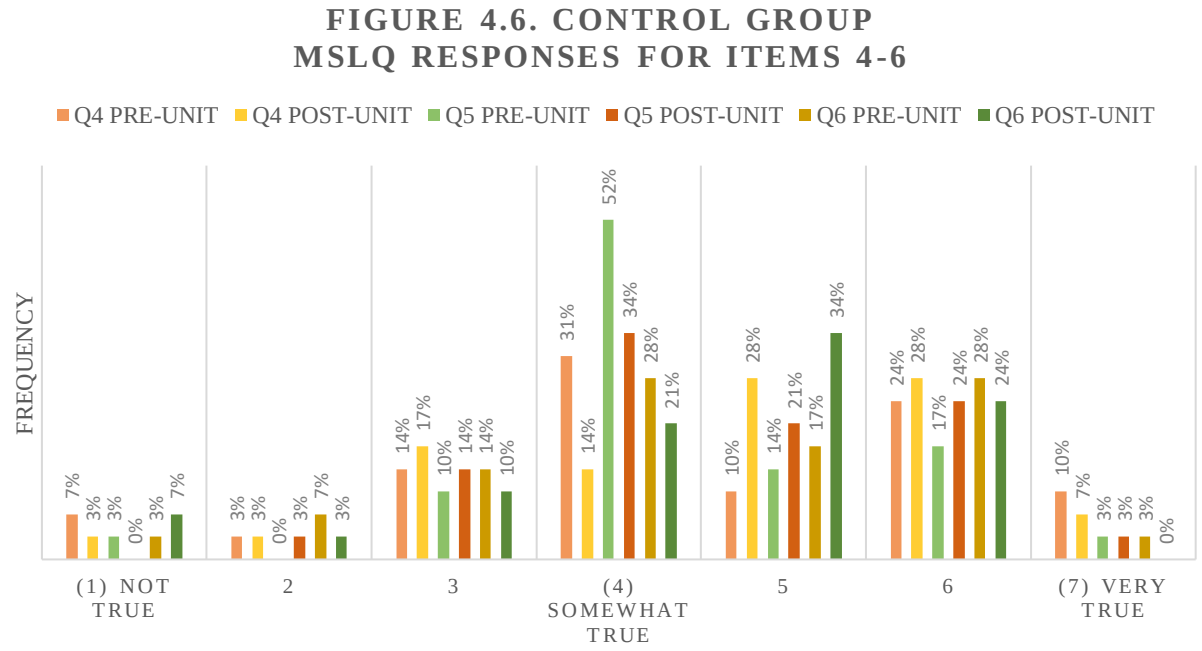

Figure 4.6 exhibits the frequency differences between the pre-unit and post-unit responses of questions 4-6 of the control group

Finally, in Figure 4.7 below the bars represented the control groups' responses on MSLQ items seven through nine. These items were:

7. My study skills are excellent compared with others in this class.
8. Compared with other students in this class I think I know a great deal about the subject.
9. I know that I will be able to learn the material for this class.

When the data points were examined for this last set of MSLQ items the largest majority of student responses for the control group ranked all questions at a level four (Somewhat True).

What was striking about student responses for MSLQ items seven through nine in the control group was that many of the respondents did not change their pre-unit rankings on their post-unit set of rankings. In comparison with the treatment groups responses illustrated in Figure 4.4, the control group responses, Figure 4.7, had less overall growth from pre-unit to post-unit administration of the MSLQ instrument. In addition, a greater frequency of respondents in the control group ranked their sense of self-efficacy lower on the MSLQ Likert scale than did the respondents in the treatment group.

FIGURE 4.7. CONTROL GROUP MSLQ RESPONSES FOR ITEMS 7-9

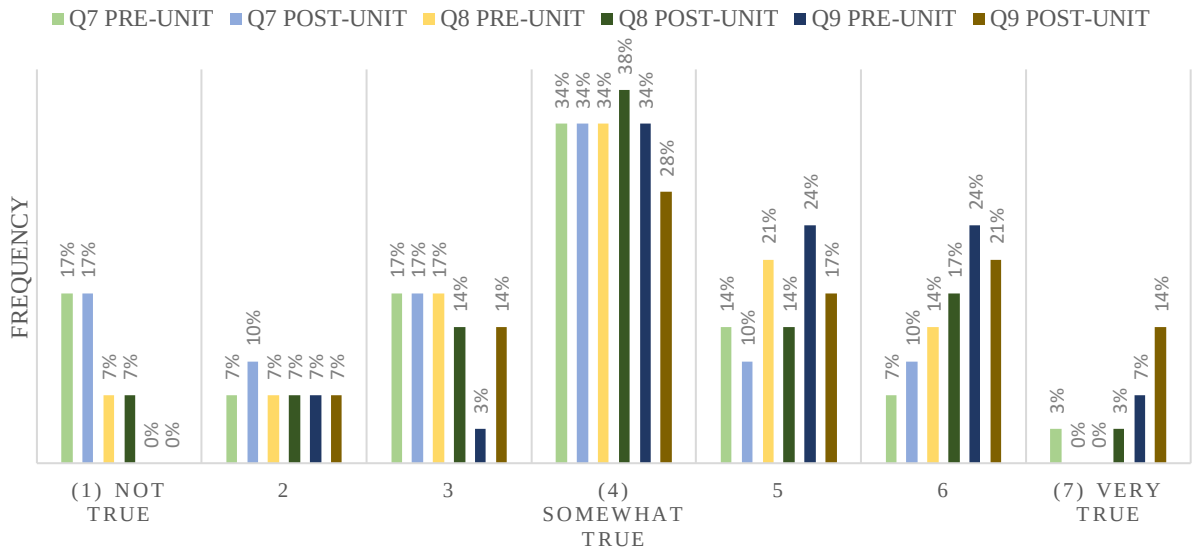

Figure 4.7 exhibits the frequency differences between the pre-unit and the post-unit responses of questions 7-9 for the control group

Conclusion

This study investigated the impact that self-assessment using the biology: Flow of Matter and Energy self-scoring guide (See Appendix B) had on students in a rural, economically-disadvantaged high school during the 2016-2017 school year. The researcher was interested in determining the level of significance of impact on student achievement for a unit of study, and

for significance of impact on student self-efficacy. The research questions were: (1) Is there a significant effect on student achievement when students use self-assessment scoring guides in biology class, and (2) Is there a significant effect on student self-efficacy when students use the self-assessment scoring guides in biology class? For the first research question the hypothesis was H_0 = There will be no significant difference in the achievement scores of those students who used the self-scoring treatment versus those students who did not use the self-scoring treatment. For the second research question the hypothesis was H_0 = There will be no significant difference in the MSLQ mean scores of those students who used the self-scoring treatment versus those students who did not use the self-scoring treatment.

The data collected to investigate the first research question consisted of student achievement scores for a unit of study (Flow of Matter and Energy). Both the treatment group and the control group were assessed using the Tennessee Biology I Item Sampler for the Flow of Matter and Energy. Participants pre-test and post-test scores were collected at the beginning and the end of the unit and recorded in an Excel spreadsheet for analysis. The treatment group was allowed to use the Biology I self-scoring guide (See Appendix B) for the Flow of Matter and energy standards. This was administered four times within the unit of study over a four-week period. The control group did not receive the self-scoring treatment. The analysis tools that were utilized to study the impact of the self-scoring guides on student achievement consisted of the paired t-test and the independent t-test assuming equal variances.

For the second research question, data were collected using the *Self-Efficacy subscale of the Motivated Strategies for Learning Questionnaire* (MSLQ) (Pintrich & De Groot, 1990). This questionnaire was administered to the treatment group and the control group. Participants were given the questionnaire before the unit of study began, and once again after the unit had

concluded. Each participant's mean score on the MSLQ was calculated and recorded twice using an Excel spreadsheet for later analysis. The analysis tools that were used consisted of the paired t-test and the independent t-test assuming equal variances. In addition to the quantitative data, the research included qualitative data in order to examine the magnitude of impact that was present or not between and within the two study groups.

Chapter 5 discusses the implications of the data analysis presented in chapter 4 on future research. In addition, the next chapter summarizes the study and the discusses the findings uncovered in Chapter 4.

CHAPTER 5: Conclusions, Implications, and Recommendations

Introduction

This study focused on assessing the impact of using self-scoring guides as a form of self-assessment to improve student achievement and student self-efficacy. The study examined the level of significance that occurred when students used a self-scoring guide (See Appendix B) during a unit of study within the high school biology class. The dependent variable in this study consisted of student performance on a standardized assessment, and student self-efficacy as evidenced by student responses on the *Self-Efficacy subscale: Motivated Strategies for Learning Questionnaire* (See Appendix A) (Pintrich & De Groot, 1990). Study participants from a treatment group (45) and a control group (28) were given the MSLQ twice; once before the unit of study began and once more when the unit of study concluded. They also received the Tennessee Item Sampler assessment for the Flow of Matter and Energy standard before and after the unit was taught. Study participants' responses on the MSLQ and scores on the state assessment were recorded using an Excel spreadsheet. The following data analysis methods were utilized: the paired t-test, the f-test, the independent t-test assuming equal variance, and descriptive measures such as mean, standard deviation, and frequency of ratings chosen by study participants for each MSLQ questionnaire-item; both pre-unit and post-unit. The research questions and their related null hypothesis were as follows:

1. Is there a significant effect on student achievement when students use self-assessment scoring guides in biology class?
    a. H_0 = There will be no significant difference in the achievement scores of those students who used the self-scoring treatment versus those students who did not use the self-scoring treatment.

2. Is there a significant effect on student self-efficacy when students use the self-assessment scoring guides in biology class?
    a. H_0 = There will be no significant difference in the MSLQ mean scores of those students who used the self-scoring treatment versus those students who did not use the self-scoring treatment.

Summary

This study was conducted in a rural, economically-disadvantaged high school located in the southeast region of Tennessee. The school had an enrollment of 385 students. The study participants consisted of 73 students enrolled in the 2016-2017 Biology I class. The participants in this study were 10th-grade students. Of the 73 students who participated in the study, 45 were included in the treatment group and 28 were included in the control group. The treatment group received the self-scoring guide (See Appendix B) a total of four times during the Flow of Matter and Energy unit of study. The control group did not receive the scoring guides. Each group was administered the Tennessee Item Sampler assessment for that unit of study and their achievement scores were recorded for the pre-test and the post-test. In order to address the first research question, the achievement scores of the pre-test and the post-test for each group were analyzed using the paired t-test for each group. Additionally, the independent t-test assuming equal variance was used to analyze the post-test achievement scores between the treatment group and the control group to investigate whether the difference seen between the two groups was significant or just a circumstance of random chance.

The second research question concerning the impact of the self-scoring guide (See Appendix B) on student self-efficacy was addressed using the t-test; paired and independent. The MSLQ instrument was used to measure the impact of the self-scoring guide on self-efficacy

and was administered twice as a pre-unit and a post-unit measurement. Both groups were administered the MSLQ in the same manner. The paired t-test was utilized to examine the significance of the mean MSLQ scores between the pre-unit and the post-unit scores for each group. Subsequently, the independent t-test assuming equal variance was employed to examine the difference in mean MSLQ post-unit scores between the treatment group and the control group. Once again, an f-test was conducted to make sure that the appropriate independent t-test was used.

Conclusions

Student Achievement. The paired t-test resulted in a rejection of the null hypothesis that stated there would be no difference in student achievement scores for the treatment group and the control group. The treatment groups' results illustrated that there was a significant difference between participants' pre-test and post-test scores [$t(44) = 16.69$, $p < 0.001$]. The treatment groups' mean pre-test achievement score was 11.79 points out of 26 possible points, and the mean post-test achievement score, after treatment, was 19.43 points out of 26 points.

The control groups' results indicated that there was a significant difference between participants' pre-test and post-test scores [$t(27) = 9.58$, $p < 0.001$]. In like manner, the difference between the pre-test and the post-test scores for the control group were significant. However, the control groups' mean pre-test achievement score was 8.04 points out of 26 points, and the mean post-test achievement score for the group was 13.68 points out of 26 points. While both groups modeled a change in scores from pre-test to post-test, the treatment groups' post-test scores were 7.64 points higher than their pre-test, and the control groups' post-test scores were only 5.64 points higher than their pre-test.

The independent t-test assuming equal variance resulted in the rejection of the null hypothesis demonstrating that there was a significant difference between the treatment groups' post-test scores and the control groups' post-test scores [$t(72) = 6.39$, $p < 0.001$]. The treatment groups' mean post-test score was 19.43, and the control groups' mean post-test score was 13.68. This statistical test helped to verify that the treatment groups' achievement performance was significantly higher than the control groups' achievement performance on the Tennessee Item Sampler for the Flow of Matter and Energy unit of study.

In addition to the quantitative analysis detailed in this chapter, the treatment groups' achievement performance doubled the control groups' achievement performance when examined from a qualitative perspective. The treatment groups' pre-test scores for the number of items correct out of 26 points was 34%, and the number of items correct for their post-test scores was 75% of the items correct. In contrast, the control groups' pre-test scores for the number of items correct was 31%, and the number of items correct for their post-test scores consisted of 52% of the items correct. The treatment group improved their achievement scores from pre-test to post-test by 41% compared to the control group that had an improvement in achievement scores from pre-test to post-test of 21%.

Conclusions

Student Self-efficacy. The paired t-test utilized for the second research question resulted in a rejection of the null hypothesis for the treatment groups' mean self-efficacy score. The treatment groups' results illustrated that there was a significant difference between participants' pre-unit self-efficacy and post-unit self-efficacy [$t(44) = 4.37$, $p < 0.001$]. The treatment groups' mean pre-unit self-efficacy score was 5.12 points on the MSLQ scale, and the mean post-unit self-efficacy score, after treatment, was 5.73 points on the MSLQ scale.

The control groups' paired t-test resulted in accepting the null hypothesis for this study; there was no significant difference in the pre-unit versus the post-unit mean self-efficacy score for the participants in the control group [$t(27) = 0.55$, $p > 0.01$]. The control groups' mean pre-unit self-efficacy score was 4.24 points on the MSLQ scale, and the mean post-unit self-efficacy score for the group was 4.37 points on the MSLQ scale. According to the paired t-test results for the control group, the difference in participants' pre-unit versus post-unit mean self-efficacy score could have occurred randomly.

The independent t-test assuming equal variance resulted in the rejection of the null hypothesis, demonstrating that there was a significant difference between the treatment groups' post-unit self-efficacy scores and the control groups' post-unit self-efficacy scores [$t(72) = 5.79$, $p < 0.001$]. The treatment groups' mean post-unit self-efficacy score was 5.73 points on the MSLQ scale, and the control groups' mean post-unit self-efficacy score was 4.37 points on the MSLQ scale. In addition to the results discussed above, this statistical test helped to show that the treatment groups' mean self-efficacy score was significantly higher than the control groups' mean self-efficacy score on the MSLQ subscale.

In addition, when analyzed qualitatively, the treatment groups' self-efficacy ratings trended higher on the seven-point Likert scale. The control groups' self-efficacy ratings clustered more around the middle portion of the MSLQ subscale. In general, the treatment group demonstrated higher self-efficacy rankings when compared to the control groups' self-efficacy rankings. Interestingly, when the histograms in chapter four were examined, the control group had little to no change in self-efficacy as compared to the treatment group, and in several cases, participants' self-efficacy declined in the control group.

Implications

The findings of this study demonstrated the impact of self-assessment through the use of a self-scoring guide on student achievement and student self-efficacy. The study confirmed that the practice of self-assessment by students plays an important role in student achievement and self-efficacy. Self-efficacy has long been studied in varying context, and it has been shown that higher self-efficacy will result in higher student achievement. This is particularly important when considering the link between student self-efficacy and student achievement among high school students (Shahrzad, Kourosh, Mohammad, Haitham, & Hossein, 2011).

Because self-efficacy is an important component in student achievement, it is important to develop methods in which an instructor can boost self-efficacy among adolescent students. Other studies have shown that one way to build self-efficacy is to through mastery experiences (Pajares & Urdan, 2006). When students regularly experience mastery of a learning outcome, they begin to develop more pride in their ability to achieve. While participants in both groups of this study showed increases in their achievement on a unit of study in the biology class, the impact of that achievement was more prominent for students who were allowed to self-assess using the self-scoring guide (See Appendix B). In addition to greater achievement on the Tennessee Item Sampler for the Flow of Matter and Energy unit, the treatment groups' results demonstrated that participants in the treatment group had a significant increase in self-efficacy, whereas the control group did not. The use of the self-scoring guide allowed students the opportunity to self-assess, which gave students a chance to experience mastery of their own learning.

The importance of building self-efficacy through mastery experiences in order to improve student achievement is a practice that more instructors should employ within the classroom,

especially for adolescents. The self-scoring guide (See Appendix B) used in this study was created by the researcher, and had been used previously within her classroom for several years. While student achievement in prior years was positively impacted, there was no research to support the use of the scoring guides in an effort to improve student achievement and self-efficacy. However, the results of this study confirmed that student achievement and self-efficacy can be increased for students in a rural, economically-disadvantaged high school. Furthermore, this study adds to the existing research on the topic in the context of adolescent students enrolled in a Biology I course for a rural school.

Recommendations

Future study should include students from a larger population of participants from urban and suburban schools. This study consisted of a small population of participants (73) in a rural, southeastern community in Tennessee which had little ethnic diversity. This same study could be repeated at other schools across the state/country with varying degrees of economic wellness as well as varying degrees of ethnic diversity.

Another area of future research could include the use of similar self-scoring guides (See Appendix B) for different subject matter as well as different grade levels. It would be interesting to investigate the impact of this kind of self-assessment on other standards-based subjects such as mathematics and reading.

Additionally, future research could be conducted to explore the use of similar self-scoring guides for use in an ACT preparation programs. The researcher has developed such scoring-guides for the four areas of the ACT; English, Reading, Mathematics and Science Reasoning. It would be interesting to determine if those self-assessments had an impact on student ACT scores.

A correlational study could be conducted that explored the magnitude of correlation between using the self-scoring practices as a form of self-assessment in order to improve self-efficacy in females versus males, exceptional education students versus regular education students, and economically disadvantaged students versus non-economically disadvantaged students. This would add valuable insight in the area of learning differences and the factors that affect these differences, such that the implications of the study could foster improvements in pedagogy, which could be customized to meet more students' needs.

Another focus of future research could investigate what impact that self-assessment might have on students enrolled in RTI courses. This could include an analysis of the difference in impact on RTI for math skills versus RTI for language arts skills when those students are allowed to self-score in order to track their own progress.

Future research could include a quantitative and qualitative analysis of the impact that improved self-efficacy via self-assessment might have on student attendance rates. Many schools today are struggling in the area of student attendance, which plays a critical role in academic success. The impact of self-assessment on student self-efficacy for students who attend private schools versus public schools, both of accredited and non-accredited affiliation, could be analyzed. This might be of interest considering the current political climate concerning vouchers.

Conclusions

This study investigated the impact that self-assessment had on student achievement and self-efficacy. The study concluded that students who were allowed to self-assess via self-scoring guides (See Appendix B) experienced greater achievement and increased self-efficacy than students who were not allowed to self-assess in this manner. While the data indicated that

students who used the self-scoring guides experienced significantly higher achievement on their post-tests, there is room for improvement. The data for both the treatment group and the control group resulted in a significant difference in post-test achievement scores between the two groups. Additionally, the data demonstrated that participants in the treatment group experienced an overall improvement in self-efficacy, whereas participants in the control group did not experience an overall improvement in self-efficacy.

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Appendices

Appendix A
Self-Efficacy Scale

Self-Efficacy subscale from the Motivated Strategies for Learning Questionnaire (MSLQ) <u>for Middle and High School students</u>

Pintrich and De Groot, 1989

	Not at all true of me 1	2	3	Somewhat true of me 4	5	6	Very true of me 7
1. Compared with other students in this class I expect to do well.	1	2	3	4	5	6	7
2. I'm certain I can understand the ideas taught in this course.	1	2	3	4	5	6	7
3. I expect to do very well in this class.	1	2	3	4	5	6	7
4. Compared with others in this class, I think I'm a good student.	1	2	3	4	5	6	7
5. I am sure I can do an excellent job on the problems and tasks assigned for this class.	1	2	3	4	5	6	7
6. I think I will receive a good grade in this class.	1	2	3	4	5	6	7
7. My study skills are excellent compared with others in this class.	1	2	3	4	5	6	7
8. Compared with other students in this class I think I know a great deal about the subject.	1	2	3	4	5	6	7
9. I know that I will be able to learn the material for this class.	1	2	3	4	5	6	7

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Motivated Strategies for Learning Questionnaire by Paul Pintrich, David Smith, Teresa Garcia, and Wilbert McKeachie.

Appendix B
Biology Self-Assessment Scoring Guide
Created by:
Elishea Roberts

Biology I: Analysis of Standards Mastered
Source: Item Sampler "Flow of Matter & Energy" Unit

Circle the question numbers for which you marked correct answers. The following numbers match the test questions from the FLOW OF MATTER & ENERGY ITEM SAMPLER. Then write the total number of correct answers for each section.

3.1-Interpret a diagram that illustrates energy flow in an ecosystem. total _____
1 2 3 4 5

3.2-Distinguish between aerobic and anaerobic respiration. total _____
6 7 8 9 10 11

3.3-Compare and contrast photosynthesis and cellular respiration in terms of energy transformation. total _____
12 13 14 15 16 17 18

3.4-Predict how changes in a biogeochemical cycle can affect an ecosystem total _____
19 20 21 22 23 24 25 26

****For each section in the table below, shade the box that corresponds to your level of achievement for each standard.**

Standard	Advanced	Proficient	Basic	Below Basic
3.1-Intrepret a diagram that illustrates energy flow in an ecosystem	5 correct	3-4 correct	2 correct	0-1 correct
3.2-Distinguish between aerobic and anaerobic respiration	5-6 correct	3-4 correct	2 correct	0-1 correct
3.3-Compare and contrast photosynthesis and cellular respiration in terms of energy transformation	6-7 correct	4-5 correct	2-3 correct	0-1 correct
3.4-Predict how changes in a biogeochemical cycle can affect an ecosystem	7-8 correct	5-6 correct	4-3 correct	0-2 correct

****Number ranges in the table below are reflective of total number of items correct on the test.**

Cells EOC	Advanced	Proficient	Basic	Below Basic
Overall Score	21-26	14-20	11-13	0-10