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Impact of an Intervention to Improve Self-Regulation Skills among Students in the Introductory Biology Course at a Southern Technical College

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DEDICATION

This work is dedicated to my family. To my beautiful daughters, Aislin, Lauren James, and Evi, I want you to remember that all things are possible with hard work and sacrifice. The time with Mommy that you've missed out on has made this possible. I hope that you will always see the value in yourselves and the education that you receive. While certain experiences like this are difficult, they are always worth the work and wait.

To my wonderful husband, Jamie, thank you for all of the days when you had to be the parent answering all of the endless questions. I love you; today more than yesterday and tomorrow more than today.

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ABSTRACT

This paper describes a problem of practice centered on Introductory Biology students' at a southern technical college's struggle for course success due to an insufficient ability to self-regulate. It is the concern of the researcher that many students do not experience course success because of their poor time management skills, lack of self-reflective behaviors, and failure to correct unsuccessful habits. Wilde and Hardaker (1997) refer to the need for college students to self-regulate as a form of educational "autonomy" which places a larger portion of the learning in the hands of the student rather that solely at the hands of a lecturer. As college learning is a shift from traditional instructor regulated learning that takes place in much of K-12 education, there is a greater need for self-regulation in order to successfully navigate the coursework. Similarly, in order to establish lifelong learning habits that will benefit students beyond college and into their working fields of expertise, self-regulation is a necessity for extended success. This research will examine the effectiveness of an intervention that attempts to increase students' self-regulatory ability by answering the following question: What is the impact of the Self-Regulation Skill-Building Assignment Model on students' ability to self-regulate?

Garcia and Pintrich (1994) assert that "if students believe that their learning is under their control and they can enact certain behaviors that will result in better performance, they will be more likely to use those cognitive tools" (p. 17). The Self-Regulation Skill-Building Assignments attempt to give the learners autonomy over their

study habits, choices, and techniques with prompts and feedback that give the students direction and focus while taking their preferences, course loads, and other responsibilities into account. Gains scores will be assessed via pretest/posttest completion of a widely used measure of self-regulatory ability, the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich, Smith, Garcia, and McKeachie (1991).

Keywords: *action research, self-regulation, introductory biology, first-year college students, study skills, metacognition*

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CHAPTER ONE: RESEARCH OVERVIEW

Introduction

Background

Higher education is typically associated with novel learning tasks and materials, new goals, and a high degree of autonomy. These often unfamiliar educational expectations can hamper student success in preliminary courses, as their high school experiences might not have adequately prepared them for higher education. Zimmerman (2002) argues that "few teachers effectively prepare students to learn on their own. Students are seldom given a choice regarding academic tasks to pursue, methods for carrying out complex assignments, or study partners. Few teachers encourage students to establish specific goals for their academic work or estimate their competence on new tasks" (p. 69). These practices are integral in a student's ability to self-regulate and are a key feature of students who can successfully navigate the transition to higher education. The construct of self-regulation refers to the degree to which the learner is metacognitively, motivationally, and behaviorally active in their own learning process, and in attainment of his or her own learning goals (Schunk, 2005, 2008; Pintrich, 1999; Zimmerman, 1989). For the purposes of this action research, self-regulation will be operationally defined as a set of behaviors that allow students to identify strengths and weaknesses of content recall and knowledge, the ability to manage effort toward mastering predetermined critical content, and the ability to determine the need for help with successful identification and utilization of support (Cohen, 2012; Dinsmore,

Alexander, & Loughlin; 2008; Mahlberg, 2015; Zimmerman et al. 2000). The teacher-researcher notices that a lack of transferable, self-regulative practices can result in first-semester biology students being left at a disadvantage and unable to meet academic expectations. As the ability to self-regulate is considered a key component of student success (Hofer & Sinatra, 2010), students benefit by instruction that aims to enhance awareness and use of self-regulatory strategies (Dignath & Büttner, 2008).

The unique environment of an Introductory Biology course is designed to promote student understanding of a wide variety of biological models, including concepts in molecular biology, cell biology, and organismal biology. The importance of undergraduate introductory sciences courses to the progression of students in the sciences cannot be overstated and instructors, this participant-researcher included, frequently try to impress upon students that their success in prerequisite courses will increase their likelihood of future success in science courses. The American Association for the Advancement of Science (2011) extols the virtues of introductory undergraduate science courses in their role as the primary pathway for an array of students to develop an understanding of scientific concepts; an appreciation for scientific inquiry; and problem solving and decision making techniques fundamental to scientific literacy. Understandably, this involves students being introduced to a lot of new material in a very short time period and learners often find difficulty with the breadth and amount of material being covered.

As an example of the vast amount of new material associated with science coursework, Smith-Walters, Mangione, and Bass (2016) note that the specialized language, the speed at which new terms are introduced, and the word load associated with

the sciences can be obstacles for students. Many studies found that science texts often introduce students to more terminology and vocabulary than they would be expected to learn if they were being introduced to a new language (Harmon, Hedrick, & Wood, 2005; Groves, 1995; Yager, 1983). In their review and synthesis of the literature regarding vocabulary instruction, Harmon, Hedrick, and Wood (2005) assert that the technical science terminology might not be the biggest challenge for struggling students as "The nontechnical words, words that are not conceptually loaded terms but are used frequently in science textbooks, are words that are rarely addressed instructionally by teachers" (p. 272). This deluge of information and lack of specific addressing from instructors, contributes to the difficulty of learning and appropriately using biological terms in context. Often, this is viewed as lack of effort on the part of the student and many instructors feel that this is a downfall of previous educators or the high school from which they graduated. While previous experience obviously plays a role in educational outcomes, these types of issues are often a product of student not knowing what or why they are lacking. Self-regulation requires students to independently plan, monitor, and assess their learning; taking an active role in controlling his or her behavior in an effort to reach established learning goals.

In high school, students will spend entire weeks covering subjects that college professors cover in just a few hours. The needs of the students are often met within the classroom and diverse techniques to cover the material are promoted by the instructor. This dynamic is reversed in the college classroom as instructors briefly cover a wide range of material during a lecture and with the expectation that students independently review the material at length. Armbrister et al. (2009) assert that the nature of the

traditional lecture environment also plays a role in students' lack of success in introductory biology courses, stating that:

> Although a traditional lecture course may be effective for efficiently disseminating a large body of content to a large number of students, these one-way exchanges often promote passive and superficial learning (Bransford et al., 2000) and fail to stimulate student motivation, confidence, and enthusiasm (Weimer, 2002). As a consequence, the traditional lecture model can often lead to students completing their undergraduate education without skills that are important for professional success (National Research Council [NRC], 2007; also see Wright and Boggs, 2002, p. 151) (p. 203).

This introduces another dilemma among students concerning study techniques and habits. Many students exhibit poor time management skills and tend to "cram-and-dump" before a test, a mechanism that affords them no permanent ability to recall the material but, hopefully, allows them to retain enough basic information long enough to complete the task at hand. Awareness of one's weaknesses, time management skills, and the adjustment of study techniques for maximum effectiveness all stem from a student's ability to self-regulate (Duncan & McKeachie, 2005; Pintrich, 1991).

Further adding to the problem, the teacher-researcher has observed that many students taking courses at two-year colleges are nontraditional students, having been out of high school for several years or having never completed a high school degree, leaving them with a very limited knowledge of biological concepts, if any. Many nontraditional students are now living away from any type of family support, have personal financial responsibility, and are attempting to complete a degree and work full or part time.

Students from community and technical colleges often have many personal and financial responsibilities that their younger counterparts do not, including children, spouses, and a full-time job. The limitations of this diverse population of learners, compounded with the breadth of material presented within introductory biology courses create a learning environment with a deep need for students to self-regulate in order to succeed.

Statement of the Problem

The problem of practice for this research stems from the students' difficulty in transitioning from a secondary to a postsecondary learning environment, specifically the students' lack of self-regulatory skills, in concert with the nuances and difficulties associated with science learning. The college learning model is very different from the high school learning model, in that students are forced to self-regulate as opposed to the instructor-regulated learning environment present in most secondary-school systems. This lack of instructor directed learning often leads students to become frustrated with the material and achieve below their individual potential (Nordell, 2009).

The American Associate of Community Colleges (2015) reports that than 46 percent of U.S. undergraduates are enrolled in community colleges. Groups underrepresented in STEM [science, technology, engineering and mathematics], as well as first-generation college students, make up a significant portion of students on community college campuses. Carnevale, Smith, and Strohl (2010) from the Georgetown University Center on Education and the Workforce estimate that by the year 2018 22.4% of the STEM workforce (p. 52) and 31% of the healthcare workforce (p. 50) will be filled by those that hold associate degrees (most commonly conferred by community colleges). Undercutting this prospective increase in students seeking degrees in the STEM fields,

findings from the latest report from The National Center for Higher Education Management Systems state that South Carolina has one of the lowest retention rates among two-year institutions with 48.9% of first-year students returning for their second year (National Center for Higher Education Management Systems [NCHEMS], 2016). The growing role of community colleges in workforce development means that introductory courses, providing a framework for future classes, are essential to student progress and success.

Post-secondary Introductory Biology courses are designed to build large conceptual outlines for use in subsequent Biology courses. The generality of the material regularly leads to lectures being consumed with the dissemination of large amount of often-unfamiliar information in an unfamiliar vocabulary. This trend lends to the fact that high achievement within these courses will often require large amounts of time spent reviewing and learning that material outside of the classroom. "Unlike K–12, postsecondary learning environments generally are built on the assumption that students are responsible for creating their own opportunities for learning" (Tomanek & Montplaisir, 2004, p. 254). Gordon Uno (1988) identified imparities in many struggling first-year biology students; specifically

1) a lack of a solid science background,
2) an inability to think critically,
3) a negative or indifferent attitude toward science, and
4) a lack of self-discipline and study skills. (p. 213)

CSTC students who exhibit Uno's (1988) identified limitations have these weaknesses contribute highly to their inability to self-regulate and are therefore, “at risk” of failing to complete a post-secondary degree at CSTC.

Student success rates among the CSTC’s Introductory Biology course are often limited because students are unaware of the specific nature of how to self-regulate their study habits. Self-regulating students have the ability to plan appropriate study skills, monitor the effectiveness of those study habits, and adjust those skills and habits to specific coursework as needed (Shell & Soh, 2013, Zimmerman, 1989). Bembenutty (2002) finds that successful learners use appropriate learning strategies and maintain high levels of motivation associated with their educational endeavors. As the volume and difficultly of material increases over time within the Introductory Biology course and in subsequent coursework, the Biology courses often see low pass and retention rates from students that have difficultly self-regulating their study techniques and habits.

The obstacles that prevent student success within Introductory Biology courses at the college level are not struggles of which instructors are unaware. An older study by Tomlinson and Tomlinson (1975), argues that “Students entering into the study of biological science at the college level need to develop skills in the special techniques of reading and studying science material to make the best use of their academic potentials” (p. 2). Tomlinson and Tomlinson (1975) took action to improve student success by including both reading and study-skills in the curriculum for Introductory Biology classes at University of California at Riverside, resulting in a marked increase in the number of successful freshman biology students.

More recently, Belzer, Miller, and Shoemake (2003), upon introducing coursework that was specifically designed to introduce students to content specific study skills and metacognitive skills, areas in which they found students lacking, believe that the outcomes of these inclusions to the course "demonstrate that the benefit of students learning how to learn far outweigh the cost of including study skills in the curriculum" (p. 40). These types of courses are becoming extremely common within higher education, as many first-semester or first-year students are being required to take courses designed to help them acclimate to the college climate, i.e. the increase in courses entitled "College 101," "College Skills," or "Freshman Seminar". Integrating content specific skills into the coursework has shown to have an increase on student success. Zhao, Wardeska, McGuire, and Cook (2014) find that it is "crucial to introduce [students] to metacognitive learning strategies, thereby giving them the opportunity to self-regulate" and that this is of particular importance to students that "come to college with few time-management or learning skills" (p. 48).

Several studies have found that students with poor self-regulatory skills are often the least likely to successfully complete a degree (Cohen, 2012; Mahlberg, 2015). The diverse student population at CSTC includes learners with varying academic abilities and learning styles, many of which require developmental interventions designed to enable them to successfully complete required coursework. Differentiated instruction is grounded in the idea that because students will have different learning styles, they should be taught using lessons/mechanisms that allow students to capitalize on their individual learning strengths (Donche et. al, 2013; Morgan, 2014; Robinson, Maldonado, & Whaley, 2014). Unfortunately, due to limitations on instructors and instructional time,

addressing every student learning modality and need during class may be almost impossible. As stated previously, self-regulating learners are able to determine appropriate study materials and habits independently making them better able to learn the material, therefore, it is integral in a post-secondary setting that students are able to self-regulate.

Purpose Statement

The identified purpose of this action research is to evaluate the impact of introducing Self-Regulation Skills-Building (SRSB) Assignments on student's ability to self-regulate in the Introductory Biology course at Central Southern Technical College (CSTC) (a pseudonym). More specifically, the research will measure the impact of the SRSB Assignments on student's self-regulatory abilities via the Motivated Strategies for Learning Questionnaire (MSLQ). The SRSB Assignment model prompts students to pinpoint weaknesses in content knowledge while still allowing them autonomy in their selection of study tools and techniques. The aim of the SRSB assignment is to increase the study skills of the students by aiding them in developing personalized study skills and by increasing students' self-confidence during assessments. In general, this study will also outline the mechanisms used to prompt students to develop personalized study techniques and assess the impact of this intervention on student perceptions of their study techniques and abilities to self-regulate.

Research Question

The following research question is advanced for this study:

> What is the impact of the Self-Regulation Skill-Building Assignment Model on students' ability to self-regulate in an Introductory Biology course?

Rationale for the Study

Linda Nilson (2014) notes that undergraduate and graduate students commonly have difficulty self-regulating, specifically stating that students commonly "see learning as something that is "happening" to them, and our job [as educators] is to make it happen and make it easy". Currently, many, if not most, of the participant-researcher's students at CSTC lack appropriate self-regulatory skills and find success in the Biology coursework to be particularly difficult. Central Southern Technical College (CSTC) (2016) defines success rates as "the number of students receiving a final grade of an A, B, or C, divided by the total number of final grades at the end of the course" and retention rates as "the number of students receiving a final grade divided by the total number of students who initially enrolled in the course" (p. 3). The Fall 2015 Success and Retention Report showed an average success rate of 81.6% and an average retention rate of 80% among Introductory Biology courses (CSTC, 2016, p. 12). Consequently, these success and retention rates indicate that ~35% of those enrolled within the course did not complete the course or were unsuccessful in the Fall 2015 semester.

Student success rates among the CSTC Biology courses are often limited because students are unaware of the specific nature of how to self-regulate the studying necessary for a particular course. It has been the researcher's experience that almost all students recognize the need to study if they desire to be successful in the course, but the study skills in use among students are often a product of what they see others doing or what they feel they "should do" and not individualized skills that function appropriately for each student. Unsuccessful students seem to lack the ability to adjust their habits in accordance with their results and have extreme difficulty managing their time. In sum,

these students lack the ability or motivation to self-regulate and their grades and pass rates suffer because of this deficit. Self-regulating students have the ability to plan appropriate study skills, monitor the effectiveness of those study habits, and adjust those skills and habits to specific coursework as needed. As the volume and difficultly of material increases over time within the Introductory Biology course and in subsequent coursework, the Biology courses often see low pass and retention rates from students that have difficultly self-regulating their study techniques and habits.

Action Research Methodology

Action research is best suited for this particular study because of the researcher's desire to focus" specifically on the unique characteristics of the population with whom a practice is employed or with whom some action must be taken" and its ability to provide results that "have immediate and direct application" (Mertler, 2014, p. 4). Upon reading the 314 articles that make up the *SAGE Encyclopedia of Action research*, Bob Dick (2015) found that there are five overarching themes that comprise action research.

> First, action research is an extensive endeavour, a large family of diverse methods united primarily by values and intentions and processes. Second, in all of its many variations Action research is almost always participatory. The participation is regarded as a means of obtaining good outcomes and also as a worthwhile end in itself. Third, Action research is action oriented. It is intended to bring about improvement in local situations and in the world. Fourth, critical reflection is an almost-universal component. Fifth, to determine how the desired changes might be achieved and theorised, and to implement them, Action Research uses a cyclic

or spiral process that integrates the action and critical reflection. At its simplest, the cycle alternates between the action and the reflection. (Dick, 2015, p. 432)

Because action research is designed to focus on the population in need (i.e. the population for whom this participant-researcher has defined a problem of practice), the results of the action research study can have an immediate and precise impact upon the students and the curriculum being used. This is an extremely desirable outcome for most educators, as traditional experimental results may not necessarily have validity among specific populations, least of all those that the instructor specifically wishes to target.

Action research differs from traditional research in that action research focuses interventions and actions on the students within the researcher's classroom. Traditional research is often used to study the relationship an experimental (manipulated) variable has on a classroom. McNiff and Whitehead (2006) provide a simple differentiation between traditional and action research in saying that "you use traditional research when you want to show an 'if…then…' relationship between variables, and you use action research when you want to find ways of taking action to improve learning with social intent" (p. 26). Brown, Dressler, Eaton, and Jacobsen believe that "educational action research is often associated with classroom inquiry that guides practice through activities, interventions and reflection that teachers engage in as part of their day-to-day work and can be undertaken by individual teacher-researchers" (p. 62). Mertler (2014) specifically addresses the weakness associated with the use of traditional research in the classroom stating that "traditional educational researchers have a tendency to impose abstract research findings on schools and teachers with little or no attention paid to local variation (i.e., not all schools are the same) and required adaptations (i.e., the extent to which

research findings generalize across entire populations) (p. 13). Due to these limitations in traditional research, educators often turn to action research in an effort to affect immediate change upon their teaching approach and classroom outcomes.

The focus of this study is to address the problem of practice of students' inability to self-regulate by introducing an intervention designed to increase the students' ability to self-regulate. This study will include the four stages of the cyclical research sequence central to the use of action research:

- Stage one of the study involves the identification of my problem of practice and narrowing of focus via a review of related literature culminating in the formulation of a research plan (Chapter 2);
- Stage two involves the collection and analysis of data via implementation of the Self-Regulation Skills-Building Assignment Model;
- The third stage will involve implementation of changes to the pedagogical practices used based upon the findings of the aforementioned intervention;
- The fourth stage of the model will involve reflection upon the findings of the study and analysis of any results, inclusive of limitations of the study, necessary revisions, and directions for future research (Mertler, 2014).

As action research is designed to improve individual teacher's instruction and classroom outcomes, the action research methodology is well suited to address problems of practice seen within specific classroom environments.

Summary and Conclusion

The problem of practice for this action research involves the Introductory Biology students' inability to self-regulate and its impact upon the success of students within the

course. This research will examine the effectiveness of attempting to increase students' self-regulatory ability by answering the following question: What is the impact of the Self-Regulation Skill-Building Assignment Model on students' ability to self-regulate? Generally, first-year college students are expected to perform with a higher level of autonomy than they are accustomed. When combined with large and unfamiliar content load and vocabulary, students that struggle to self-regulate are at risk of being unsuccessful in the course and in attaining their desired degree. Integrating tasks designed to boost self-regulation has been shown to improve student success and overall course outcomes (Boekaerts, 1999; Nandagopal & Ericsson, 2012; Travers, Sheckley, & Bell, 2003; Van Grinsven & Tillema, 2006; Wernersbach et al., 2014).

This Action research study aims to assess the overall effects of integrating activities designed to promote self-regulation into the Introductory Biology course on the students' ability to self-regulate.

Overview of Dissertation

The remainder of the study is organized in four additional chapters. Chapter Two contains the literature review which examines the theoretical framework associated with this study, the constructs of metacognition and self-regulation, as well as research regarding community and technical college populations. A detailed report describing the setting and the methods used in the present action research study follows in Chapter Three, as well as the process for data analysis. Chapter Four describes the findings of the study and the interpretation of the results. The dissertation concludes with Chapter Five, which includes a plan emphasizing the implications of the study and suggestions for future research. The present Action research will culminate in an action plan for CSTC to

implement the SRSB Assignment Model, which will be aimed at enabling students to pass the Introductory Biology course as well as subsequent biology courses.

Glossary of Terms

The following definitions of terms relevant to this study were compiled through a review of past and present literature (Boekaerts, 1999; Pintrich, 1999; Risemberg & Zimmerman, 1992; van Grinsven & Tillema, 2006; Zimmerman & Mirtinez-Pons, 1988)

1. **Autonomy:** Freedom of control or freedom of choice.
2. **Cognition**: The process or action through which knowledge is acquired.
3. **Deep learning:** Learning that is focused on contextualization and application of the material, often involving critical thinking, problem solving, and self-regulation.
4. **External regulation:** Means by which the instructor regulates learning.
5. **Planning strategies:** Student strategies that involve setting goals for use of their current cognitive strategies for future use.
6. **Metacognition**: Higher level thinking that allows one to think about and understand his or her own learning processes.
7. **Monitoring strategies:** The process of students evaluating the success or failure of their learning strategies based upon a self-determined benchmark for success.
8. **Regulation strategies:** Determinations of success and adjustments for accomplishment based upon the evaluation of monitoring strategies.
9. **Retention rate**: The rate at which students successfully complete a course, with a C or better, and are able to move on to a subsequent course.
10. **Self-efficacy**: A positive perception of one's abilities to complete a goal, in this context a learning task specifically.

11. **Self-evaluation:** Student-initiated judgment about the quality of his or her work.
12. **Self-reaction:** A student's decision to modify or not modify his or her practices based upon self-evaluation.
13. **Self-regulation**: A student's ability to self-evaluate and self-react based upon his or her ability to metacognitively and motivationally participate in his or her learning.
14. **Shared regulation:** Means by which the instructor and the student share in the regulation of learning.
15. **Skills-building**: A growth or increase in one's ability to perform a task (In this instance a student's increased ability to self-regulate)
16. **Strategies**: The process/relationship between a student's thoughts and actions and the outcomes and consequences of those thoughts and actions.
17. **Surface learning**: Learning that often involves cognitively passive behaviors such as memorization, often lacking understanding or application of the material.

CHAPTER TWO: THEORETICAL FRAMEWORK AND REVIEW OF RELATED LITERATURE

Theoretical Framework

Dewey's Theory of Experience. John Dewey's (1938) theory of experience, asserts "that there is an intimate and necessary relation between the processes of actual experience and education," emphasizing that personal, past experience is a critical consideration in education, as personal perceptions and experiences influence educational outcomes. Dewey's theory rests on the continuity of experiences, in which past experiences are kept and used in future situations, and interaction, in which one assumes that his or her current experience is a function of the interaction between the experiences of the past and what he or she is experiencing at present. With this, Dewey links all experiences, educative, social, good, and bad, to one another and claims that there separation is impossible as "all genuine education comes about through experience" (p. 25).

Dewey himself notes that not all experiences are equally valuable and states that some experiences can be considered "mis-educative" in that they arrest or distort the growth of further education and "narrow the field of further experience" (p. 25). Dewey (1938) asserts that it is possible for students to lose their motivation to learn simply because of the way in which the learning was experienced, specifically posing the question "How many [students] found what they did learn so foreign to the situations of life outside the school as to give them no power or control over the latter?" (p. 27). As

most students are originally exposed to scientific principles outside of formal education, their initial experiences could easily be mis-educative and serve to facilitate the formation of misconceptions about the biological principles that govern the world around them.

John Dewey's (1938) Theory of Experience, asserting that personal, past experience is a critical consideration in education, presents a problem that plagues many introductory college courses. Students in introductory college courses often mimic, with the best intentions, the practices that lead to success in high school (Conley, 2008). Because the college learning model is very different from the high school learning model, where presentation and learning of the material are often both achieved via instructor driven, in-class methods, new college students will often become frustrated with the content due to the removal of the instructor centered learning environment, leading students to achieve below their individual potential (Nordell, 2009). Dewey asserts that "an experience may be immediately enjoyable and yet promote the formation of a slack and careless attitude; the attitude then operates to modify the quality of subsequent experiences to prevent a person from getting out of them what they have to give" (1983, p. 26). These high school experiences might hold value at the time of the experience, but I would argue that these experiences are what Dewey refers to as "defective from the standpoint of connection with further experience" and act as one of the critical disconnects between new college students and introductory course success (Dewey, 1938, p. 27.)

Dewey uses the term interaction to describe past experiences and future goals influencing the experience in the present (Dewey, 1938, p. 42). A major goal of the SRSB activities is to modify the students' perceptions based upon past experiences and to

give students the opportunity to build a diversified set of personal experiences in order to build a better repertoire for future use. The SRSB activities allow students to direct their own learning experiences by creating an opportunity for students to pinpoint difficulties with the material, personalize their study materials, and propose a plan of action, in a forum that permits constructive feedback from instructors but is not instructor driven.

Constructivism. From the perspective of constructivism, learners construct new knowledge based upon their preexisting understanding of the world around them. Constructivists assert that new knowledge is often a result of individuals making connections between new information and old information. Richardson (1997) identifies constructivism, not as an educational policy, but as a "meaning-making theory" during which "meaning is formed and reformed on the bases of an interaction (or transaction) between prior meaning and new experiences" (p. 3). Students' experiences, past perceptions, and prior knowledge interact with new experiences and help to influence interpretations of the environment or context. Dhindsa and Anderson (2004) state that "Constructivist teaching is a process of helping students mobilize their prior understandings and reorganize them in light of current experience" (p. 64). In summary, constructivist practitioners pay special attention to the previous knowledge that learners bring with them into science courses and view learners as active participants in the construction of the new knowledge.

Piaget's Constructivism. Jean Piaget is considered by many to be one of the most influential figures in developmental psychology, specifically for his work on how individuals develop cognitive processes from infancy to adulthood (Huitt & Hummel, 2003). Piaget's theory of cognitive development rests upon two types of behaviors that

individuals use to situate themselves in the world around them: assimilation, "using or transforming the environment so that it can be placed into pre-existing cognitive structures," and accommodation, in which individuals modify their pre-existing cognitive structures in order to accept something from the environment (Huitt & Hummel, 2003). The schema that Piaget proposed for learning includes the successive movement through several stages of situational adaptation, during which learners construct knowledge through their efforts toward assimilation and accommodation. Teachers who take a personal, adaptive view of knowledge are known as constructivists because their model of learning theorizes that all knowledge is constructed by the individual in a structure of accommodation and assimilation.

Social Constructivism and Situated Cognition. Vygotsky, like Piaget, studied cognitive development and specifically focused his work on concept formation and conceptual change in children (Howe, 1993). In contrast to Piaget, Vygotsky emphasized the social aspects of education and asserted that "children are cognitively developed in the context of socialization and education" (Ozer, 2004, para. 9). Read (2004) asserts that "Vygotsky believed that the tools acquired from everyday experience were closely related to real phenomena, but lack coherence, whereas those acquired in a school environment were coherent but were isolated from real phenomena by the context in which they were acquired. Thus, the purpose of instruction is to help bring these tools together, so that concepts acquired from everyday experience could be integrated into a coherent framework, and the tools acquired from school instruction become usable in everyday situations" (p. 3). This 'situated cognition', is grounded in the theory that

people's knowledge is a function of the context, activity, environment in which it was learned.

Wilson and Meyers (2000) present situated cognition, as a theory where "thinking and learning making sense only within particular situations, as thinking, learning and cognition are situated within particular context" (Wilson & Meyers, 2000). Per this assertion, knowledge is highly situative and is constructed within a given context. Novak (2002) believes that situated cognition is responsible for undergraduate students being overly reliant upon rote memorization, as it often yields positive results in the form of grades. According to Edmondson and Novak,

> Most Cornell University students achieve their high grade point averages by rote learning—which they do very well. Unfortunately, most of this "knowledge" soon becomes irretrievable from long-term memory, and even if recalled, seldom can the learner utilize the knowledge in new contexts, as in novel problem solving. This inability to transfer knowledge is sometimes referred to as "situated learning." Thus much of this high "achievement" is really fraudulent or inauthentic (Edmondson & Novak, 1992) (p. 549).

In this instance, rote memorization has made students successful in the context of school but ill prepares them to be in real world situations that require application of the knowledge and deeper learning. Similar arguments can be made about students that struggle in the transition from high school to college. The experiences of students in secondary schools could hamper their ability to self-regulate, as their instructors have regulated the distribution and acquisition of knowledge via techniques that require very

little effort outside of the classroom. This reliance upon and reinforcement of surface learning can leave many students underprepared for post-secondary educational demands.

Constructivism and Self-Regulation. Kingir et al. (2013) asserts that self-regulation is an integral part of constructivist learning, stating that "Using a set of cognitive and metacognitive strategies, and having goals and motivation to attain those goals, are essential factors for effective learning" (p. 207). As social constructivists assume that the previous educational and social experiences of students will mitigate those students' future learning, one can only assume that students in current courses will employ previous "successful" learning techniques. Dignath-van Ewijk and van der Werf (2012) assert that "constructivist learning implies students' self-direction of their learning, based on the idea that it is insufficient to regulate one's cognitive activity when participating in active knowledge construction; but also metacognitive, affective, and behavioural aspects need to be regulated [11]. Students can benefit from learning environments that allow them to take over responsibility for their own learning [43]" (p. 6). Constructivism declares the necessity of self-regulation as part of creating a powerful learning environment, included in the constructivist mandates of "activating prior knowledge (relating new knowledge to already existing knowledge), cooperative learning (social interaction), [and] learning in context" (Dignath-van Ewijk and van der Werf (2012), p. 5).

An instructor's view of the relationship between self-regulation and constructivism will help to determine the pedagogical-content knowledge of the instructor, effecting the teaching strategies used. While constructivist educators focus upon the construction of knowledge through educational endeavors, "beliefs on fostering

SRL also include beliefs on how to instruct and how to foster strategy use, which goes beyond general pedagogical beliefs, for example, in terms of beliefs on how many strategies to instruct at a time, or how to integrate the instruction of a certain strategy into the content of a lesson, as well as measures taken to support transfer of strategy use to other contexts" (Dignath-van Ewijk and van der Werf, 2012, p. 3).

While each of these theories professes the virtues of considering the previous experiences of students, social constructivism and situated cognition recognize the importance of social context. Students are a product of more than just previous classroom instruction. If one is to assume that learning is an experiential process, you must consider all experiences as learning experiences, not just those that are explicitly labeled education. Within this frame, science learning is seen as a complex process in which the learner's previous practices interact with new information and influence how that information is retained and used.

Review of Related Literature

Introduction

The Literature Review is intended to introduce the reader to the Self-Regulation Skill-Building (SRSB) Model and the existing research on Models designed to impact postsecondary students' self-regulation, including what it means to be a self-regulated learner and the impact that the ability to self-regulate one's learning has upon overall student success in college. Research on the impact of self-regulation on college students, and science students specifically, will be discussed. Some of the mechanisms involved in the SRSB Model that involve self-regulation and the teaching of self-regulation are discussed in this literature review. The literature review concludes with a discussion

regarding the role of the community college and the challenges and issues involved with educating today's students for future work and post-secondary schooling in the United States and specifically in the South.

Self-Regulation

Self-Regulation and Metacognitive Skills. Zimmerman and Martinez-Pons (1988) define self-regulation as students' ability to be "metacognitively, motivationally, and behaviorally active participants in their own learning process" (p. 284). Schraw, Crippen, and Hartley (2006) summarize self-regulated learning as consisting of three main components: cognition, metacognition, and motivation. Cognition includes skills necessary to memorize, recall and encode information. Metacognition includes the recognition of factors that affect learning as well as the skills used to adjust cognitive processes. Motivation includes the attitudes and beliefs that affect how one uses and develops cognitive and metacognitive skills. Each component is necessary for self-regulation to occur. For example, Zimmerman (2000) asserts that those possessing cognitive skills but lacking the motivation to use them do not achieve at the same level of performance as individuals who possess both cognitive skills and the motivation to use them.

Metacognition is probably most notably defined by Flavell (1979) as "knowledge and cognition about cognitive phenomenon" (p. 906). This broad definition is more concisely defined as students thinking about their knowledge and knowledge processes. Expanding upon the mechanics of this definition, Veenman (1997) defines metacognitive skillfulness as "reflecting on the nature of the problem, predicting the consequences of an action or event, planning and monitoring the ongoing activity, comprehension

monitoring, checking the results of one's actions, testing for plausibility, and reflecting on one's learning performances" (p. 188). Travers, Sheckley and Bell (2003) effectively link self-regulation to constructivist instruction, asserting that self-regulation occurs as a byproduct of dissonance as "When their experiences do not match their expectations, individuals typically broaden their internal reference standards in a way that increases the level of cognitive complexity to their thoughts"(p. 2). In sum, self-regulation is an active process in which students consistently assess and adjust their individual techniques to increase learning and performance.

For first-year college students, metacognitive skills are often viewed as a determinant of success. Larmar and Lodge (2014) refer to students' "metacognitive capital...as an overarching determinant of student learning that serves to build upon existing approaches to student participation in higher education" indicating that metacognition and self-regulated learning are an integral part of student success. Zhao et al. find that it is "crucial to introduce [students] to metacognitive learning strategies, thereby giving them the opportunity to self-regulate" and that this is of particular importance to students that "come to college with few time-management or learning skills" (2014 p. 48). Cummings (2015) even goes so far as to suggest that college instructors that do not teach metacognitive skills to their students "may be leaving new students in a struggle to adapt to the demands of college" (p. 68).

Although there exists a great deal of research on the benefits of possessing metacognitive skills (Magno, 2010; Romainville, 1994; Veenman, Wilhelm, & Beishuizen; 2004; Young & Fry, 2008; Zimmerman, 2000), the methodologies necessary to enhance the metacognitive skills of students is limited (Peters and Kitsantas, 2010). As

self-regulation encompasses metacognitive skills, the methodologies behind introducing a shared regulation strategy are more approachable and attainable. Therefore, this study will focus on the effectiveness of a method designed to enhance self-regulation in Introductory Biology students.

The Self-Regulated Learner

Zimmerman (1990) has helped to pioneer the field of self-regulated learning (SRL), which he concisely defines as "how students become masters of their own learning" (p. 4). Although there are many models of self-regulation, including Boekaerts' Model of Adaptable Learning, Borkowski's Process-oriented Model of Metacognition, and Pintrich's General Framework for SRL, Zimmerman's Social Cognitive Model of Self-regulation seems to be the most referenced (Puustinen & Pulkkinen, 2001). Zimmerman (1990) identifies a self-regulated learner as someone who will

> approach educational tasks with confidence, diligence, and resourcefulness. Perhaps most importantly, self-regulated learners are aware when they know a fact or possess a skill and when they do not. Unlike their passive classmates, self-regulated students proactively seek out information when needed and take the necessary steps to master it. When they encounter poor study conditions, confusing teachers, or abstruse text books, they find a way to succeed. Self-regulated learners view acquisition and systematic and controllable process, and they accept greater responsibility for their achievement outcomes. (p. 4)

A major indicator of self-regulation is a student's ability to control his or her own learning. Pintrich (1999) notes that most models of self-regulation depend upon a student's ability to utilize three basic strategies: planning, monitoring and regulating.

Planning activities include actions like goal setting and task analysis, and are relevant in that they help students plan for cognitive strategy use. Pintrich (1999) links planning to student success in that those making good use of planning stages will "activate or prime relevant aspects of prior knowledge" in order to make the task at hand easier (p. 461). Monitoring includes activities by which students measure their learning against some criterion or pre-established goal. Regulation strategies are closely linked to monitoring strategies as it assumes that as students monitor their progress, they will make any necessary changes in behaviors that will bring them in line with their goals. The most basic principle behind self-regulation is goal setting and the student's actions toward achieving those goals. Mikroyannidis et al. (2014) assert that "the goal setting process of SRL encourages the learner to define the outcome of his or her learning process as well as identifying strategies with which to reach those goals" (p. 148). Pintrich (1999) asserts that "All these strategies are assumed to improve learning by helping students correct their studying behavior and repair deficits in their understanding" (p. 462).

Self-Regulation in Primary and Secondary School Students. There are many studies that describe the positive impact of self-regulation on primary and secondary school students, (Dignath & Büttner, 2008; Leopold & Leutner, 2015; McClelland, Acock, & Morrison, 2006; Schmitt, Pratt, & McClelland, 2014) including those aimed at select, specific populations of students, such as gifted students, those with special needs, and those that have been deemed to have behavior problems (Nelson, Hyte, & Greenfield, 2016; Lichtinger & Kaplan, 2015, Sawyer et al., 2015). Virtually all of these studies have linked a successful self-regulation with academic success, or at the very least deep learning when possible. It is worth mentioning that many of these studies included

references to the effect of extraneous variables, such as socioeconomic factors, sex, race, ableness, ethnicity, or being part of a single-parent house hold, upon a student's ability to self-regulate.

McClelland, Acock, and Morrison (2006) used data from 538 students that were part of a study of early individual differences conducted in Greensboro, NC. The Cooper-Farran Behavioral Rating Scales (CFBRS; Cooper & Farran, 1991) is a teacher rated, Likert-scale based questionnaire used to assess children's learning-related skills, including the fields of self-regulation, responsibility, independence and cooperation. After measuring math and reading skills in the second and sixth grades, the data was analyzed for relationships between the learning skills assessed in kindergarten and the two reading and math skill measures. External factors were also taken into consideration and one of the more notable findings of the study was "that children rated as having low learning-related skills shared a number of problematic child, family and sociocultural characteristics at kindergarten" (McClelland, Acock, & Morrison, 2006, p. 483). Ultimately, the findings of the study indicate that learning-related skills present or acquired by kindergarten had the strongest effect on children's growth in reading and math early in elementary school (K - 2nd grade). In a similar study, Schmitt, Pratt, and McClelland (2014) examined the relative effectiveness of teacher and observer ratings, and a direct assessment of behavioral self-regulation in predicting achievement outcomes of 247 children in 31 preschool classrooms. Correlations between the assessment methods and student achievement indicate that teacher ratings and direct assessment methods are more closely linked to academic behaviors. While this study's focus is the validity of the self-regulation assessment methods, one cannot overlook the fact that the

assessments link student achievement, classified as early math skills and early literacy skills, with self-regulatory ability in these preschool students.

Dignath and Büttner (2008) performed a meta-analysis of studies done since 1992 that included interventions that foster self-regulation in primary and secondary school students. A search of primary literature yielded 74 studies and contained a sample of 8,619 students overall. While differences existed surrounding the type of self-regulation strategies that interventions should use in primary versus secondary school students, the overall impact of self-regulation interventions was a positive one. Implications of the research are that "at primary school level, students' need for encouragement and motivational support should be taken into account, while at secondary school level, interventions should build on the strategic repertoire that students have already acquired by then. For both school levels, long-term interventions should provide enough opportunities to practice and automate strategy use in order to facilitate transfer to other learning situations" (Dignath & Büttner, 2008, p. 258).

Lichtinger and Kaplan (2015) conducted structured interviews and observations of 8 Jewish-Israeli elementary students that were diagnosed as learning disabled and were placed in traditional classrooms. When these students were assigned a task, the researchers "were able to construct empirical pictures of the step-by-step process of each student's purpose, goals, and the strategies that he or she employed during task engagement" (p. 143). The overall findings indicated that for these students, the self-regulatory mechanisms being used depended heavily on and were situated within the goals that the students set for themselves. Sawyer, Miller-Lewis, Searle, Sawyer, and Lynch's (2015) longitudinal study focuses on 510 children in Southern Australia and how

increases or decreases in self-regulation over time influence the students' behavior. Student behavior was assessed via questionnaire by both teachers and parents at ages 4 and 6. The children's self-regulation was rated by parents at ages 4, 5, and 6 years using the Self-Control subscale of the Devereux Early Childhood Assessment (DECA; LeBuffe & Naglieri, 1999). The overall findings of the study indicate that children with higher parent-reported self-regulation at 4 years old, as well as those that were reported to have improvement in their self-regulatory abilities from ages four to six, were least likely to have reported behavioral issues at age six (Sawyer et al., 2015). Nelson, Hyte, and Greenfield (2016) used a single student case study approach to analyze the usefulness of interventions aimed at correcting dysregulation of self-regulatory skills in a blind and learning-disabled 5-year-old boy. While the study involved multiple parts, the overarching theme was to recognize the dysregulation and provide an intervention that allowed for meaningful and active participation while helping to bring the deregulatory behavior back in line. Ultimately, the authors assert that the interventions applied were "successful in reducing behaviors that indicated dysregulation and, concomitantly, increasing … active participation in school activities." (p. 507).

Self-Regulation among College Students The research into the self-regulatory habits of college students seems to be a newer field with the focus being on first-year college students, substantiating the assumption many students will have learned to appropriately self-regulate before college or shortly after entry. Those studies that target self-regulation among college students seem to focus many upon differentiating between self-regulated learners and those that do not self-regulate. Nonetheless, the studies have shown similar results as those conducted with younger students in that self-regulated

learners are often high achieving academically. Bouffard, Boisvert, Vezeau and Larouche (1995) administered questionnaires to 702 French College students from two colleges in an effort to assess students' orientation toward learning and performance goals. Analysis of the results and patterns found within the answers provide evidence that college students' ability to self-regulate is the best predictor of academic achievement, even over the students' internal motivation. While Bouffard et al. (1995) find that self-regulation is a major indicator of academic success, their study focused more on the impact that being goal oriented versus performance oriented and trends in relationship to gender have on students' self-regulatory ability. Specifically, the authors note that "students strongly inclined toward both performance and learning used more cognitive strategies and obtained better academic performance" and that female students tended to fall into this pattern more than their male counterparts (Bouffard et al., 1995, p. 325). While this examination of motivation and gender impact are valuable, as the dominant gender in this study is similarly female, there is little information regarding mechanisms aimed at enhancing self-regulation.

In specific reference to college learning, Janssen (1996) poses that all college students should be able to master a body of material within a given discipline and should be able to individually adjust their approach to learning to master said material, for example, skilled college students are able to self-regulate. Hailikari and Parpala (2014) conducted a study in which 93 students beginning their second year at University of Helsinki were asked to self-report via questionnaire regarding factor that enhanced or impeded their learning. Those results were correlated with student responses that indicated a tendency toward deep learning or surface learning. While there were obvious

correlations between factors that impede learning and surface learning, as well as, factors that enhance learning and deeper learning; most relevant to this study, the authors found that "students with good organizing, or more precisely, self-regulation skills for planning and monitoring their studying are survivors who are able to overcome the obstacles that come in their way during their studies" (Hailikari and Parpala, 2014, p. 819).

The self-regulated learner is adaptable and motivated to adjust his or her learning techniques to meet the needs of the course. Studies have proven that self-regulated learners have more success in college courses than their counterparts that are unable to self-regulate (Bouffard, Boisvert, Vezeau, & Larouche, 1995; Kitsantas, Winsler, & Huie, 2008; DiFrancesca, Nietfeld, and Cao, 2016). DiFrancesca, Nietfeld, and Cao (2016) sought information regarding the differentiation between high and low achieving students regarding self-regulation variables. Forty-one students in undergraduate psychology courses at two separate southeastern universities were chosen as representative of high and low achieving students. When associating different facets of self-regulation with student achievement, the authors found that students that exhibit adaptive SRL patterns such as effective goal setting, goal monitoring, and approaches to studying tend to be high-achieving. Nandagopal and Ericsson (2012) examined the use of self-regulation strategies of sixty upper level college students majoring in science. The students were divided into three groups based upon GPA: high achieving (GPA >3.7), average achieving (GPA <=3.7 and >=3.0), and low achieving (GPA<3.0). These students were then asked to keep daily diaries concerning their activities, including specific information about what they were studying, when they were studying, and how they were studying. Each student also participated in an interview used to determine his

or her self-regulatory habits. The finding of the study indicate that "students who had attained higher grades in prior semesters were found to use a larger number of different strategies and were more likely to engage in strategies such as organizing and transforming, seeking information, and reviewing strategies more than low-achieving students" (Nandagopal and Ericsson , 2012, p. 605). Ultimately, the authors assert that one of major differences between high/average and low achieving students is the amount of time that the students are dedicating to strategies like seeking assistance, seeking assistance early, and organization, suggesting that "interventions guiding low-achieving students...to improve their study habits will increase the quality of students' learning and, ultimately, their performance on subject matter tests" (p. 606). While there are some suggestions regarding improving self-regulation, such as online problem solving and "think-aloud" strategies, there is no mention of a strategy deemed successful at increasing the self-regulation of beginning sciences students nor are these strategies linked specifically to the successful increase of self-regulation in science students.

Uzuntiryaki-Kondakci and Capa-Aydin's (2013) analysis of 365 university chemistry students in the Middle East, found that students that were considered highly self-regulatory also displayed a higher level of critical thinking skills (p. 669). The students self-reported in a questionnaire that is a blend of the Motivated Strategies for Learning Questionnaire and the Chemistry Self- Efficacy Scale. The authors also found a relationship between metacognitive self-regulation and chemistry self-efficacy in that "Students who take responsibility of their own learning, in other words, students using self-regulatory strategies effectively, tend to be higher in efficacy" (Uzuntiryaki-Kondakci and Capa-Aydin's, 2013, p. 669). While this study is very specific to chemistry

students and the relationship between chemistry self-efficacy and self-regulation, the implications validate the usefulness of studying self-regulation in Introductory Biology students as the author's specifically link self-regulation skills to critical thinking ability. Overall, the focus on self-regulation on the college level seems to indicate that students would benefit from some guided introduction to the mechanisms associated with self-regulation.

Teaching Self-Regulation/Learning to Learn

Brown, Campione, and Day (1980) asserted that in order to "become expert learners" students "must learn about their own cognitive characteristics, their available learning strategies, the demands of various learning tasks and the inherent structure of the material … tailor[ing] their activities finely to the competing demands of all these forces in order to become flexible and effective learners" (p. 15). Many refer to activities that enhance self-regulation as "learning to learn" activities (Brown, Campione, and Day, 1980; Schmitz et al., 2014). Hautamäki et al. (2002) assert that learning to learn is not solely concerned with subject specific content or success on assessments but consists of

> diverse cognitive and affective factors that guide pupils' learning and life at school… factors [that] not only direct the learning process and performance in different subjects at school, but they are also reflected in the way in which pupils are capable of applying their learning to novel tasks presented to them. (p. 10)

Knowing that students will possess a variety of learning techniques and that community college students will represent diverse social and socioeconomic groups, self-regulation will be an extremely diverse and individualized process.

Bembenutty (2009), more specifically, states that there are three essential components of teaching college students, the determination of known information, teaching students how to determine which metacognitive strategies are appropriate for the material they are trying to learn, and teaching students how to self-regulate. Ley and Young (1999) prescribe four compensatory strategies that instructors can use to help students that have difficulty self-regulating: (1) prepare a structured learning environment (2) organize the material in a manner that enhances learning, (3) us instructional goals and feedback to facilitate monitoring, and (4) provide information for evaluation, or more specifically so that students can self-evaluate the quality of their work. Environmental structuring enables students to work within a distraction free environment that is quiet and comfortable. This often requires students to assess their learning environment for potential distractions and make adjustments in order to permit appropriate focus. Organization of material is important for instructors and students. Ley and Young (1999) maintain that "Strategies that organize content, such as concept mapping, schematizing, and structured overviewing have boosted achievement in several studies investigating the relationship between instruction and structural knowledge (Jonassen & Grabowski, 1993)" (p. 96). Monitoring, as mentioned earlier, involves students measuring their progress toward a goal. This allows students to reassess their needs and make changes with the intention of realignment. Instructor feedback is an integral part of monitoring as it provides students external information regarding their progress. The authors note that monitoring and evaluation are often conflated but the two are linked in their purpose. While monitoring allows students to assess how close or far off they are from the goal

they've set, evaluation is the practice of making decisions about the way in which one chooses to make adjustments in order to meet that goal.

While these strategies mirror the efforts of a self-regulated learner, Ley and Young (1999) intend them specifically for use during instructional design, noting that

> Lower achieving learners are more likely to be poor self-regulators and to benefit from the high structure inherent to the SR principles. The SR principles guide the design process so that the learner is not left to choose his or her learning environment. Although SR is to some extent context dependent, instructional designers should consider using a framework of general principles that have been developed to address the distinct SR deficiencies associated with achievement levels among adult learners. (p. 97)

There are many studies that attempt to enhance student self-regulation and within these studies, interventions that include a creation of a dialog between the students and instructor(s) seem to have the most increase in student metacognition (Orange, 1999; Van Grinsven and Tillema, 2006). Van Grinsven and Tillema (2006) specifically identified teacher behaviors and learning environments that promote self-regulation as important facilitators of the learning process. Their study included 623 students in their second year of secondary education (ages 16-18) at 13 different locations in the Netherlands. Three separate questionnaires were used to measure student autonomy, teachers' behavior, and student motivation. Teacher behaviors taken into consideration disaggregate teacher behavior as: Supporting teacher behavior including leadership behavior and aspects that lead to describing the teacher as helpful or understanding, Corrective teacher behavior in which the teacher is seen as admonishing and difficult to

please, or 'Wait-and-see' teacher behavior that leaves student could leave students uncertain or feeling like they have a lot of autonomy or freedom. Covariance/correlation matrices were used to identify relationships between features of the learning environment and student motivation and self-regulation strategies. In their search to establish which learning environments were most conducive to providing opportunities for student motivation self-regulation, the authors found that student self-regulation was highest in learning environments where students were given many opportunities for autonomy that included large amounts of instructor support (Van Grinsven and Tillema, 2006).

A research study conducted by Travers, Sheckley, and Bell (2003) indicates that five specific instructional practices can be effective in helping students learn to self-regulate their learning:

> From this perspective, instructors enhance self-regulation most when they: (a) guide learners' self-images, goal setting, and expectations about how they learn (b) encourage students to reflect upon their learning (c) provide constructive feedback (d) help learners make connections between abstract concepts and (e) help students link new experiences to prior learning. According to prior research, students participating in courses led by instructors who use combinations of these techniques show significant gains in their ability to self-regulate their learning. (p. 3)

Travers, Sheckley, and Bell (2003) chose 78 students (24 in the treatment group and 54 in the control group) enrolled in a lower level math course at a New England community college and conducted a dynamic study of the impact that instruction from teachers trained in the self-regulation enhancement methods mentioned above. Their

findings indicated that student self-regulation can be positively influenced when instructors help students make choices about specific goals and provide specific "cues and feedback" about the students' regulation of their learning (p. 13). Admittedly, the sample size used by the researchers was small as only 24 participants from the treatment group completed both the pre- and post-semester analysis instruments. As this research has a similar sample size and uses a similar pretest posttest comparison methodology, the study could be considered similarly valid in its findings.

Boekaerts (1999), upon her review of literature for the development of her *Three layered model of self-regulated learning*, asserts that students provided with the maximum amount of external support, where instructors completely regulate the learning of material, students often develop minimal self-regulatory skills and erroneously believe that they can self-regulate appropriately in the future. August-Brady (2005), used a quasi-experimental, pretest-posttest design to study the effect of concept mapping on the self-regulation of 80 baccalaureate nursing students in eastern Pennsylvania. Upon implementing an intervention using concept mapping to promote deeper learning, the researcher saw few, if any, gains in regard to the students' approach to learning; noting specifically that "It would seem that nursing students in this study preferred to stay with their usual learning strategies" (p. 301). However, there was a statistically significant increase in the adaptive control beliefs of the treatment groups, indicating that students became more flexible regarding the regulation of their learning mechanisms than those in the control group. With the knowledge that external regulation of student's study skills has minimal long-term benefits for the students (Boekaerts, 1999), this study will attempt

to use shared regulation, in which the instructor provides the chance for autonomy and detailed feedback intended to help students build self-regulatory skills.

College 101 and Study Skills Courses. An increase in the commonness of "College Skills" and "College 101" courses designed to helps students transition from secondary to post-secondary education, warrants review of the literature on how these courses effect the self-regulatory ability of new college students. Wernersbach, Crowley, Bates, and Rosenthal (2014), upon researching the effectiveness of a course specifically designed to enhance study skills in undergraduates at a large four-year college, found that these courses often increase student success and decrease the student's insecurity in reference to the content. Participants in the study included 111 students categorized as academically underprepared who were enrolled in a "Strategies for Academic Success" (SAS) course and 126 students designated as a comparison group. Pretest and posttest comparisons of the two groups indicated that those that were deemed academically underprepared ended the SAS course with the same level or a higher level of academic self-efficacy as their peers in the comparison group. Ultimately, Wernersbach et al. (2014) report that "the findings indicate that over the duration of the seven-week study skills course academically underprepared students increased their self-reported skill ability and their feelings of confidence in using those skills appropriately" (p. 21). These results seem to be especially true for students that are traditionally considered underprepared for college level coursework, including students that are socioeconomically disadvantaged and those that are first-generation college students. As the population at the college where this study takes place includes high percentages of students that fall into one or both of these categories, introductory courses that include

instruction on study skills and self-regulation could increase student ability, confidence, and possibly persistence.

Zeidenberg, Jenkins, and Calcagno (2007) analyzed data provided by the Florida Department of Education following a cohort of approximately 37,000 first time enrollees to community colleges over 17 terms (just over 5.5 years). The researchers note a positive value of "student success" courses with students enrolled in these courses 8% more likely than their peers to graduate with some degree or certificate in the allotted 17 term time span (Zeidenberg, Jenkins, & Calcagno, 2007, p. 3). The authors assert that this is especially true for those who are academically underprepared or have "poorly formed goals for education and careers, a lack of good study habits, and little awareness of how to succeed in higher education settings" (p. 5). As their study only included the "student success" course required for students placed into remedial courses at select Florida community colleges, Zeidenberg, Jenkins, and Calcagno (2007) admit that the "positive marginal effect" found in their research could be coincidental but is in line with the current research (p. 5). For instance, Wernersbach et al., (2014) contend that instruction aimed at increasing study skills has a positive effect, stating that "the combination of improved skills and greater confidence is a combination that may launch academically underprepared students toward greater success" (p. 23).

In the study introduced earlier, Nandagopal and Ericsson (2012) found that there was a significant difference in the variety of SRL strategies implored and the timing with which those strategies are used in regards to high-achieving versus low-achieving college Biology students enrolled in "challenging" Biology courses. Specifically, the authors found that "studying early and using strategies such as organizing and transforming,

seeking information from external sources, and seeking assistance from peers differentiated between preGPA groups of students and significantly predicted subsequent performance“(p. 10). With this information, Nandagopal and Ericsson (2012) assert that “interventions guiding low-achieving students…to improve their study habits will increase the quality of students' learning and, ultimately, their performance on subject matter tests” (p. 606).

The Self-Regulation Skill Building Model

A previously stated, “Self-regulation would then refer to students' monitoring, controlling, and regulating their own cognitive activities and actual behavior” with many approaches focusing “on the strategies individuals use to plan, monitor, and regulate their cognition” (Pintrich, 1999 p. 461). These three aspects of self-regulation are the basis for the SRSB Model used in this study [See Appendix 1]. Students are asked to identify an area of personal weakness from the weekly lectures, to identify a resource or study technique that he or she will use to address the that weakness, to specifically plan study time in consideration of their schedule and other obligations, and to plan a test-like, self-assessment to determine if their study techniques and planning have helped to address said weakness. This Model closely aligns with Pintrich’s (1999) identified strategies of self-regulated learners: planning, monitoring, and regulating their cognition.

Planning strategies include “setting goals for studying, skimming a text before reading, generating questions before reading a text, and doing a task analysis of the problem. These activities seem to help the learner plan their use of cognitive strategies and also seem to activate or prime relevant aspects of prior knowledge, making the organization and comprehension of the material much easier” (Pintrich, 1999, p. 461).

Monitoring is an essential component of the SRSB model, as students will be asked to self-assess their learning after planning and implementing an independently identified study technique. Pintrich (1999) notes examples of techniques in which students exhibit monitoring such as "self-testing through the use of questions about the text material to check for understanding, monitoring comprehension of a lecture, and using test-taking strategies (i.e., monitoring speed and adjusting to time available) in an examination situation" (p. 461). Regulation strategies are those which, when used, are designed to "bring behavior back in line with the goal," hence the ability of students to self-regulate being a component of successful study skills (Pintrich, 1999, p. 461).

Resource management, defined by Pintrich (1999) as "strategies that students use to manage and control their environment," is an integral skill of students that successfully self-regulate (p. 462). Resource management will include time management, regulation of the study environment, and the use of the tools that are available to the students (worksheets, online resources, notes, the textbook, etc.). Managing resources is a much more difficult task for community college students, as they are more likely than their university peers to have inadequate academic skills (Zeidenberg, Jenkins, & Calcagno, 2007). Hawley and Harris (2005) assert that "Because of their unique mission of "open access" to a demographically diverse community with challenging social, economic, and academic needs, community colleges are faced with handling increased levels of developmental and remedial education"(p. 118). These needs will make demands upon the students' resources that are very different from those of traditional college students.

The SRSB Assignments [see Appendix A] used as the intervention in this study, are a short set of self-reflective prompts designed by the teacher-researcher. The SRSB

assignment prompts encourage student planning, monitoring, self-assessment, and resource management. Rowe and Rafferty (2013) find student prompts to be particularly useful in enhancing self-regulation, defining prompting as "an instructional method for guiding and supporting students to perform a specific activity as part of a learning situation," and emphasizing prompt associated benefits that "instruct students to stop and reflect on their own thoughts or consider the efficiency of their own learning strategies" (p. 592).

Important in this intervention is the integration of the intervention into the formatting of the course itself. Wingate (2006) found that one of the major downfalls of what she terms 'bolt-on' study skills initiatives, workshops or tutoring centers geared specifically toward those experiencing academic difficulty, is that they give the impression of a "quick fix" to students that are struggling. As student populations have increased in diversity in the United Kingdom and students became more nontraditional, Wingate (2006) notes that many colleges have tried various strategies to support student learning. Based on an extensive review of the literature, Wingate's ultimate assertion is that embedding key skills throughout a course is more effective when attempting to increase students' ability to effectively study for a course. Realistically, content and the ability to self-regulate one's learning are important not only in an individual course but throughout a student's academic career. Integrating self-regulatory skills into the coursework and embedding the SRSB Assignments into the online coursework is an attempt by the author to capture the attention of the students by giving them some autonomy in their assignment choices, increase a student's personal investment in the material and his or her overall educational experience.

The VARK© Assessment

The VARK© (Visual, Aural, Read/Write, and Kinesthetic) Assessment was first introduced by Fleming and Mills in 1992. The pair set out to design a facilitative survey meant to increase student focus and directedness, asserting that the mechanism used needed to be more than a "simple diagnostic tool, we wanted something that would serve as a catalyst for discussion and debate and encourage students to collaborate in the process" (Fleming & Mills, 1992, p. 139). In their literature review of interventions used to enhance online learning and self-regulation, Rowe and Rafferty (2013) suggest an exercise or questionnaire that will "prompt students to analyze their behaviors in relation to the suggestions provided by the questionnaire" (p. 599), VARK© assessment (readily found online at http://vark-learn.com/) fills this need.

The VARK© analysis is not designed to measure student motivation or every aspect of the complex construct of learning styles. "The VARK questions and their results focus on the ways in which people like information to come to them and the ways in which they prefer to deliver their communication" (VARK: Research & Statistics, 2017, para. 8). In this study, the awareness created with the VARK© Questionnaire is meant to increase student metacognition, i.e. to have students thinking about how they learn best. Students that critique the analysis appropriately, do so with self-reflection and often utilize the information to their benefit. Fleming and Baume (2006) believe that the usefulness of the VARK© questionnaire is evident in that "the use of learning strategies that are aligned with a modality preferences is also likely to lead to persistence learning tasks, a deeper approach to learning, active and effective metacognition" (p. 4). Moreover, Fleming and Baume (2006) assert that "knowing one's learning style can be

beneficial if learners take the next step, and consider how and when they learn, as part of a reflective, metacognitive process, with action to follow"; therefore, the inclusion of the VARK© questionnaire as the introduction to the SRSB assignments begins the type of self-reflective planning and monitoring processed that integral among self-regulated learners (p. 7).

Assessing Self-Regulation Ability

The Motivated Strategies for Learning Questionnaire (MSLQ) was developed by Pintrich, Smith, Garcia, and McKeachie (1991) to assess college students' motivational orientations and their use of different learning strategies. In its whole, it is a 44 item, self-reporting instrument consisting of two broad sections, one dedicated to assessing motivation and another to assess students' self-regulatory abilities. "The social-cognitive theoretical framework on which the MSLQ was founded assumes that motivation and learning strategies are not traits of the learner, but rather that motivation is dynamic and contextually bound and that learning strategies can be learned and brought under the control of the student" (Duncan & McKeachie, 2005, p. 117). This means that the MSLQ can be used as a tool to assess changes in student learning strategies and motivation.

Students rate themselves on a 7-point Likert scale, from 1 (not at all true of me) to 7 (very true of me). Scores for the individual subscales are calculated by taking the mean of the items within that particular subscale. For example, the time/study environment subscale is composed of eight items. A student's score is for that subscale is calculated by summing these eight items and calculating the mean. A few items within the MSLQ are considered "reversed" and are worded negatively, so the scale/score must be reversed in order to correctly calculate the score for those items (Pintrich et al., 1991). Post reversal,

the overall score for a given subscale represents the positive wording of all items within that scale and so higher scores indicate greater levels of the construct being measured (Duncan & McKeachie, 2005).

To ensure validity of the instrument, correlational studies were "carried out on over 2,000 students during the 5 years of funding for the National Center for Research to Improve Postsecondary Teaching and Learning" and were considered to "have shown fairly consistent results," in which the researchers found that "students who use more deep-processing strategies such as elaboration and organization and who attempt to control their cognition and behavior through the use of metacognitive planning, monitoring, and regulating strategies are more likely to do better in their course assignments, exams, and papers as well as overall course grade" (Duncan & McKeachie, 2005). Pintrich, Smith, Garcia, and McKeachie (1993) sampled 380 Midwestern college students from 14 separate disciplines, all of which volunteered to participate in the study. Strong correlative relationship were found to exist between motivational and strategy use subscales. Similar to the 1991 study, this study also found the MSLQ to have predictive value for teachers and students in that "the scale correlations with final grade are significant, albeit moderate, demonstrating predictive validity" (Pintrich et al., 1991, p. 7). The MSLQ has been used by hundreds of researchers and instructors worldwide and has been translated into several languages, the reliability and usefulness of the MSLQ as a motivation and learning-strategies assessment has been repeatedly reinforced (see Duncan & McKeachie, 2005 for a list of empirical studies employing the MSLQ). The MSLQ will be utilized as a pre- and posttest component of the study to determine the effect of the SRSB on students' motivation and self-regulatory ability.

Self-Regulation and Under-preparedness in Diverse Student Populations

Many note that community colleges disproportionately serve diverse populations of students, many of whom are often underprepared for the academic rigor required for full time college attendance (Fike & Fike, 2008; Higbee, Arendale, & Lundell, 2005; Tinto, 1999). More specifically, Phillippe (1995) notes that "Currently, community college populations represent 44% of all undergraduates and 49% of first-time-in-college students, including many minority, low socioeconomic status, and nontraditional age students who frequently enter college less academically prepared" (p. 73). Grimes and David (2016) state that much of the increase in community college enrollment is being spurred by the "eliminating or minimizing many geographical and financial barriers that have historically restricted college access," but concede that the "social and cultural barriers [of students], with their associated educational deficits, have been more difficult to address" (p. 74). While open-enrollment policies allow many students to attend college that would otherwise be unable, the relaxed entrance requirements of many two-year colleges also allow students to enter into coursework less prepared and in more need of developmental coursework.

During their research to explore the differences in demographics between underprepared and college ready students, Grimes and David (2016) found no significant difference between reported income, gender, part-time vs. full-time enrollment, or student age (p. 78). However, the researchers did find, a significant difference in reasons for attending college, degree aspirations, and race, in particular that "Black students were represented in greater numbers in-the underprepared student group with 21 % Black students compared to 6% for the college-ready group" (Grimes & David, 2016, p. 78).

Similarly, Elloitt et al. (1996) assert that under-preparedness is the factor that contributes most to the high number of African American students leaving the sciences. Interestingly, the reasons behind why underprepared students decided to attend college sometimes differed significantly from those considered college ready. Specifically, Grimes and David (2016) found that "improving reading and study skills," "satisfying parental desires," and "experiencing difficulty finding a job" more common reasons for college attendance among the underprepared students; meanwhile "Both groups indicated obtaining a better job and making more money were two of the three most important reasons for attending college" (p. 79). Consequently, student preparedness is not solely an issue of academics or intelligence, but one that includes the social and societal pressures that mold student attitudes and culture.

The underprepared students in Grimes and David's (2016) study considered themselves less able than an had lower expectations of future accomplishments than their college ready peers and the authors assert that "lower ratings in affective areas may be causal, contributing, or resulting factors but tend to support a self-perpetuating cycle of low performance and self-esteem" (p. 86). In this instance, the student's low self-efficacy will affect the ability of the student to self-regulate. Winne (2005) suggested that self-regulation is contingent on positive self-efficacy beliefs, arguing that "learners must subscribe to a system of epistemological and motivational beliefs that classifies failure as an occasion to be informed, a condition that is controllable, and a stimulus to spend effort to achieve better" (Winne, 2005).

The Transition to the College Learning Environment

Ross et al. (2012) in the U.S. Department of Education *Higher Education: Gaps in Access and Persistence Study,* found that only 21% of 12th-graders scored at or above the Proficient level, which demonstrates a "solid academic performance" and "competency over challenging subject matter" on the National Assessment of Educational Progress (NAEP) science assessment (p. 96). Porter and Polikoff (2012) assert that the NAEP can be used as a measure of college readiness. This assessment serves to demonstrate that the disparity between populations of students with the majority of students being underprepared for college sciences courses, scoring below proficiency. Male and female students show a marginal gap, with only 18 percent of female 12th graders scoring at or above proficient (compared to 24 percent of male 12th graders), while a major gap can be found between white and black students, with 32 percent and 22 percent of 12th grade, white, males and females, respectively, scoring at or above proficient compared to 5 and 4 percent of 12th grade, black, males and females, respectively (Ross et al, 2012, p. 97). More specifically, Greene and Forster (2003) found that only 36 percent of South Carolina graduates were considered college ready based upon a three-part screening; the students' graduation from a secondary school, the student's completion of college ready coursework, and their reading competency (p. 22).

Contrary to this, Ross et al. (2012) found that over 95 percent of all 2009 high school graduates had completed a biology course in high school (p. 113). With so many graduating students completing biology courses during their high school tenure but the majority of these students score below proficiency on the NAEP, where their scores of basic "denotes partial mastery of knowledge and skills that are fundamental for proficient

work" at the 12th grade level, there are serious doubts about the preparedness of students transitioning from high school to college biology courses in both community colleges and 4-year institutions (Ross et al, 2012, p. 96).

Wheeler and Wischusen (2014) actually propose that the increase in technology associated with science based coursework and the changing architecture of information dissemination leads to a higher requirement for student driven, outside of lecture, learning. "As more faculty implement metacognition, constructivism, active and inquiry learning techniques to transition to a student-centered classroom, students will have an increased responsibility in learning. However, a majority of first-year STEM [Science, Technology, Engineering, and Mathematics] majors are unprepared to handle the innate challenges of STEM courses, not to mention the additional learning responsibilities" (Wheeler and Wischusen, 2014, p. 2). Similarly, Chen (2013) found that "less success in STEM courses than in non-STEM courses (as reflected by earning lower STEM grades relative to nonSTEM grades) was also associated with an increased probability of dropping out of college for STEM entrants at the associate's degree level" (p.

The Role of the Community College

The American Association of Community Colleges (AACC) (2016) states that public community college tuition is almost a third of the cost of public four-year institutions, $3,430 and $9,410 respectively, with 36 percent of those students being first generation college student (p. 2). Upon his completion of a five-year, qualitative study of community colleges in California, Oregon, and Maryland during which he interviewed 77 faculty and staff members and held focus groups with 115 students, Bueschel (2004) found that "Students in two-year institutions are likely to be older, more ethnically and

racially diverse and less affluent than their four-year counterparts" (p. 5). These combined factors mean that community college classrooms are comprised of a highly diverse population of students with many variations in socioeconomic status, race, age, and prior educational background.

Many sources document the fact that community colleges disproportionately serve a large proportion of minority, first-generation, low-income, and adult students (AACC, 2016; Ma & Baum, 2015). Fike and Fike (2008) write that

> Community colleges are also more likely to enroll higher percentages of minority students than the university. According to Cohen and Brawer (1996), ease of access, low tuition, and the open-door policy have contributed to the increased numbers of minority students in community colleges. Students from ethnic minority backgrounds are more likely to enroll on a part-time basis and are more likely to be from low-income families" (p. 80).

The open enrollment or relaxed enrollment policies of community colleges often allow students that do not meet the typical requirements of a 4-year institution the opportunity to attend classes with a lower financial risk and with a more suitable schedule.

Introductory Biology Attrition

Belzer, Miller and Shoemake (2003) studied the outcome of biology major's participation in a voluntary course that focused on study skills and biological though processes in a concurrently run Zoology course. While only 7.1 % of their sample was enrolled in both courses, students that were in enrolled in both courses reported feeling more aware of their weaknesses and more able to pinpoint holes in their previous study habits. In conclusion, Belzer, Miller, and Shoemake (2003) feel that there is good reason

to continue with the study skills focused course as many instructors are aware that students are underprepared for college biology coursework and that "frustrated by students' lack of preparedness but constrained by an information explosion in the sciences with no corresponding change in the amount of teaching time, we often continue on with 'business as usual,' accepting that many of our students will do poorly or drop out" (p. 30). This attitude contributes to the high attrition rates seen in Introductory Biology courses.

Data from the College Senior Survey (CSS), administered by the Cooperative Institutional Research Program (CIRP) from 20,747 2012 graduates, found that 51% of the students that started with a biology major changed to another major before they graduated (Higher Education Research Institute at UCLA, 2013). Toven-Lindsey, Levis-Fitzgerald, Barber, and Hasson (2015) state that "low rates of STEM persistence are particularly troubling among women and underrepresented minority (URM) students (URM students include African-American, Latino/a, Chicano/a, Native American, and Pacific Islander students). While women and URM students account for nearly 70% of college enrollment, they are underrepresented among STEM degree holders, because they leave STEM majors at substantially higher rates than their non-URM male peers (PCAST, 2012)" (p. 2). The authors gathered data on 533 students entering UCLA in the Fall 2009 or 2010 term and all students indicated an intent to pursue a life or physical sciences major. The overarching goal of the study was to assess the impact the Program for Excellence in Education and Research in the Sciences (PEERS), an academic support program at the University of California, Los Angeles, for first- and second-year science majors from underrepresented backgrounds. Results of the study indicate that PEERS

students, on average, earned higher grades in most "gatekeeper" math and chemistry courses, had a higher cumulative grade point average, completed more science courses, and persisted in a science major at significantly higher rates than their peers not active in the PEERS group. As CSTC serves a large number of URM students and disproportionately large number of females students, the intersection of these factors effects a large portion of the targets population for this study.

Belzer, Miller, and Shoemake (2003) argue that under-preparedness is a major contributor to the high attrition rates seen among biology students, noting that "Three major approaches, which are not mutually exclusive, have been used to help students' transition from high school to college: 1) remedial or developmental instruction (Wilkie & Foreman, 1994), 2) learning centers or tutoring (Payne, 1995), and 3) supplemental instruction (Peled & Kim, 1996)"(p. 30). Tinto (1999) asserts that the first year of college itself is developmentally important, stating that "the first year of college should be understood as a developmental year in which new students acquire the skills, dispositions, and norms needed to learn and grow throughout the college years" (p. 9). The Introductory Biology course at CSTC is designated a developmental course, designed to prepare students for more intensive coursework, most commonly, Anatomy and Physiology. "Developmental education is an essential part of the community college mission; McCabe and Day (1998) estimate that more than two million students each year would drop out of postsecondary education without participation in one or more developmental education activities" (Higbee, Arendale, & Lundell, 2005, p. 5). The developmental nature of courses promotes student retention and a narrowing of the gap between college ready and underprepared students.

Introductory Biology courses at the college level are designed to help students develop large conceptual frameworks for subsequent Biology courses to build upon. The generality of the material leads to lecture times being consumed with the dissemination of large amount of often unfamiliar information. This trend lends to the fact that high achievement within these courses will often require large amounts of time spent reviewing and learning that material outside of the classroom. "Unlike K–12, postsecondary learning environments generally are built on the assumption that students are responsible for creating their own opportunities for learning" (Tomanek, 2004, p. 254). This shift in the expectations toward out of class learning can be especially difficult for non-traditional students, i.e. single parents or those that are working full time jobs while attending classes. Higbee, Arendale, and Lundell (2005) assert that developmental education is more demanding than teaching courses that serve traditional, college-ready students in that "it is critical that developmental educators attend to the lived experiences of their students and focus on affective and cultural aspects of learning, not just on the cognitive domain" (p. 7).

Summary and Conclusion

While there has been much investigation and several theories proposed regarding self-regulated learning, the research regarding ways to enhance self-regulation is limited. Similarly, there is a gap in the research regarding ways to enhance self-regulation among science learners and those involved in introductory or developmental courses. As self-regulation has been argued an integral characteristic of successful college students, the following research regarding the SRSB Assignments as a mechanism to enhance self-regulation, adds to the growing body of literature.

CHAPTER THREE: METHODOLOGY

Introduction

Chapter Three reviews the methodology for the present action research study, including the role of the researcher, the validity of action research, the research context, and the design of the study. The chapter begins with a brief overview of the identified problem of practice, research question, and the purpose of the research. After identifying a problem of practice in which students enrolled in Introductory Biology courses, a developmental course designed to prepare students for more rigorous Biology coursework, had poor persistence and pass rates in the course due to an inability to self-regulate, the participant-researcher implemented an intervention intended to improve self-regulation among Introductory Biology students. This action research study will be used to determine the impact of the Self-regulation Skills-building Assignment Model on students' ability to self-regulate in an Introductory Biology course.

Bruce Berg (2004) defines action research as "a collaborative approach to research that provides people with the means to take systematic action to resolve specific problems" (p. 197). Berg (2004) suggested that there are three modes of action research: A) the technical/scientific/ collaborative mode, B) the practical/mutual collaborative/deliberative mode, and C) the emancipating/enhancing/ critical science mode. The technical/scientific/collaborative mode of action research is designed to "test a particular intervention based on a pre-specified theoretical framework" (p. 203). The practical/mutual collaborative/deliberative mode is designed to "improve practice-and-

service delivery" (p. 203). Lastly, the emancipating/enhancing/critical science mode includes action research intended to "bring together theory and book knowledge with real-world situations, issues, and experiences" (p. 204). The action research utilized by this participant-researcher is consistent with the emancipating/enhancing/critical science mode in that the ultimate goals empowerment of the participants leading to action and change.

Role of the Researcher

Heron and Reason (2006) argue that in traditional research "the roles of the researcher and subject are mutually exclusive: the researcher only contributes to the thinking that goes into the project, and the subjects only contribute to the action to be studied" (p. 145). In action research, the researcher is an active participant in the study instead of being an external observer, moreover, Bruce Berg (2004) notes that the "researcher contributes expertise when needed as a participant in the process" (p. 202).

In this action research study, in my role as a participant-researcher, I will serve as the instructor to the student population in question and will be responsible for the design and implementation of the intervention being reviewed. My role as an insider within the study will foster my own professional development and serve to increase my knowledge of student needs within the course. The participant-researcher has consistently taught Microbiology, Introductory Biology, General Biology, and Genetics for the department. In the past, the participant-researcher has also served as the lead instructor for the Introductory Biology courses. The most common schedule for the participant-researcher includes four courses that include both a lecture and a lab component. While that teaching assignment mainly consists of the Microbiology courses, the participant-

researcher is usually assigned at least one Introductory Biology or General Biology course per academic year.

As always, researcher bias must be taken into account. As it is the desire of all instructors for student's to be successful within a course, all efforts to maintain fairness and uniformity must be made to insure that data collected is unbiased. Ultimately, the participant-researcher role is a necessity of action research. Liz Charles and Neil Ward (2007) classify action research as "participatory" and "collaborative," noting that action research "is undertaken *by* or *with* insiders, but never by an outside 'expert' researcher" (p. 9).

Action Research Validity

Unlike typical research that attempts to disprove or provide support for a hypothesis, action research is immersive research. In action research, the researcher seeks to learn from and improve a real-world problem with real-world applications by being a participant in the research itself. Stephen Toulmin (1996) states the concisely points to the differences between scientific research, for theory, and the applicable nature of action research:

> The goal of action research is to improve, not our theories, as in physics or molecular biology, but our practices, as in medicine and engineering. Its interest lies not in abstract conceptual systems, as in mathematics but in local timely knowledge of concrete situations, as in cultural anthropology (p. 58).

This lends to action research's ability to inform researchers of contextual solutions to real classroom problems. Unlike traditional research, action research does not have to be generalized to multiple populations or entire groups, as the intervention's results will not

necessarily be applicable to every student. While scientific research obviously maintains its merit, action research does not need to maintain the tenants like reproducibility. Mertler (2014) explains that the rigor involved in action research determines validity through precision in measurement and data management as well as the accuracy of the findings. Despite any misgivings about the validity of action research, its role in eliciting social and educational change is undeniably positive and valuable.

Research Context

Central Southern Technical College (CSTC) is a public, two-year institution located primarily in Sumter, South Carolina. CSTC serves just over 4,500 students enrolled from a four county service area and offers over 50 programs of study. The instructor-researcher's role within the college is that of a Science Department faculty member, academic advisor for the Associate Degree in Nursing (AND) program, and Biology Instructor.

Demographics of the college includes a student population where 44% self-report as White and 47% as Black/African-American. The college also serves a disproportionately large number of female students (67%) and 89% of the total undergraduate population receives some form of federal (78%) or state (64%) financial aid (Todd, 2015). The U.S. Census Bureau calculates population demographics in the area where 49.2% identify as Caucasian and 47.1% as African American, therefore, CSTC is representative of the surrounding community. The area also has a median household income of approximately $43,000, well below the national median income of $52,000; this leads to a higher than normal percentage of the population living below the poverty line (almost 18%) (State & County QuickFacts, 2015).

The average class size for the sciences is approximately 18 students with a cap on enrollment in an Introductory Biology course set at 24 students per section. In the participant researcher's experience, the students enrolled in the Introductory Biology course are often disproportionately female in number, with few if any males being present within the course. Most commonly, these students have also been placed into the Introductory Biology course via unacceptable scores on the Biology Placement Test, designed to determine the students' level of preparedness for higher level Biology coursework. As the majority of the students intend to apply to the AND program, a requirement of their degree is the completion of two Anatomy and Physiology courses as well as a Microbiology course. The Introductory Biology course serves as a non-degree credit foundational course, meant to introduce basic biological concepts and provide as scaffolding upon which to build subsequent courses. Students that have chosen to take or were placed into the Introductory Biology course desire to complete the course with the intention of moving into a degree-credit course, like Anatomy and Physiology, as the Introductory Biology course acts an internal prerequisite for all degree applicable Biology coursework. Even though the classes will normally consist of students with varying motivation and capabilities, it is the participant-researchers experience that many of these students will be underprepared for the rigors of a science-based curriculum.

Design of the Study

Action research is comprised of numerous study designs. Mertler (2014) identifies four stages of the cyclical action research process as *planning*, *acting*, *developing*, and *reflecting*. I will use this model of action research in order to both design my study and answer my research question.

Planning. The first step in the action research process involves using personal and professional experiences to identify a problem of practice and narrowing the topic of interest via research and then exploring possible pathways toward completing the research. During the initial portions of the planning phase, the researcher gathered information and conducted a literature review in order to narrow the research focus and develop a manageable research question. Subsequent to the development of the research question, the researcher's focus became finding an intervention that would allow for the increase of students' self-regulatory ability within the context of the Introductory Biology course at CSTC. While many studies assessed self-regulatory skills of students (Duncan & McKeachie, 2005), interventions were varied and often lab based (Sungur & Tekkaya, 2006; Travers, Sheckley, & Bell, 2003; Wheeler & Wischusen, 2014). With the creation of this intervention, the researcher hopes to address this gap in the research in addressing self-regulation in non-lab based biology courses.

Evolution of the research focus. Previously, the participant-researcher served as the lead instructor for Introductory Biology in her department. The lead instructor is tasked with the production of course syllabi, tests, and outcome questions, the decisions about student and time appropriate labs, and the dissemination and collection of information from all of the other Introductory Biology instructors. Concerns about the course were often brought to the researcher's attention by instructors and were the common focus of many course meetings. These concerns were often centered on the students' lack of studying or study skills and the instructors' frustrations with their inability to fix the students' perceived lack of skills. This research began with a review of the literature on teaching study skills, but shifted in the direction of self-regulation when

it was found that this more appropriately describe the deficiencies that the researcher and colleagues associate with poor student performance.

Upon reviewing the literature (Chapter 2), the difficulties of first year college students (Janssen, 1996; Tomanek, 2004) especially those within the sciences (Uzuntiryaki-Kondakci & Capa-Aydin, 2013; Wheeler & Wischusen, 2014) began to become clearer. Research on self-regulation extolled the benefits of being a self-regulated learner (Bouffard, Boisvert, Vezeau & Larouche; 1995; DiFrancesca, Nietfeld, & Cao, 2016; Nandagopal & Ericsson; 2012; Pintrich, 1999; Puustinen & Pulkkinen, 2001). The value of including skills-building exercises in college courses is evident in many studies but this is commonly done as part of a stand-alone, first semester college course. Although there is some research on developing self-regulation in college students most of the research methodologies are subject specific and follow no distinct methodology (Bembenutty, 2009; Boekaerts, 1999; Oange, 1999; Van Grinsven & Tillema, 2006). This research guided the participant-researcher's formulation of the SRSB Assignment [see Appendix A] while utilizing a common evaluation of students' ability to self-regulate, the MSLQ (Pintrich & DeGroot, 1990; Pintrich, Smith, Garcia, & McKeachie 1993). This investigation preceded the development of the research question, what is the impact of the Self-Regulation Skill-Building Assignment Model on students' ability to self-regulate?

Development of the research plan. The next phase of the planning stage involves developing a research plan, specifically, the design of the study and what data will be collected in an effort to answer the research question: what is the impact of the Self-Regulation Skill-Building Assignment Model on students' ability to self-regulate. The

independent variable for this action research study is the method of instructions, specifically the addition of the Self-Regulation Skill-building (SRSB) Assignments. The dependent variable for the study is the impact of the SRSB Assignments on students' ability to self-regulate. This study design will specifically include the use of a single group pretest and posttest analysis in order to measure changes in the students' ability to self-regulate. Gain scores will be calculated and used to evaluate the effectiveness of the SRSB Assignments. The researcher's role in this instruction will be that of a facilitator and a guide, providing encouragement and suggestions to students that struggle with independently regulating their study habits. The researcher will attempt to fairly and ethically guide students in their quest to find appropriate learning resources and provide positive feedback to maintain student participation.

Ethical Considerations. Any research that involves human interactions must account for ethical considerations regarding that research. Due to the human relationships that are assured the within the student/teacher dynamic, special attention must be taken in order to ensure fairness and ethical assessment and instruction among all students within the classroom. Ethical consideration must be given in reference to the grading of assignments associated with the research, accumulation of research data, use of the research within the classroom, and the reporting of that research to others. Ethical consideration must be given in reference to the grading of assignments associated with the research, accumulation of research data, use of the research within the classroom, and the reporting of that research to others. Nolen and Putten (2007) assert that most universities and school districts within the United States observe the "three unifying ethical principles for all human subject research: respect for persons, beneficence, and

justice," adopted from *Ethical Principles and Guidelines for the Protection of Human Subjects of Research*, created by the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research in 1979 (p. 401). Adherence to these principles is of utmost importance in this research. The ethical considerations below are the participant-researcher's sincere efforts to objectively address any concerns of students, administration, and accuracy in reporting.

In consideration of the ethics of this research, the participant-researcher is most concerned with the ethical implications of tying grades to a portion of the course that she deem experimental and research worthy. Specifically, the researcher's concern lies in grading the SRSB assignments. Because these the responses and postings from students will be extremely varied, a rubric will be designed with the focus of the grading being appropriate content, that is relevant to the topic being discussed in lecture, and appropriate critique of the postings provided (See Appendix A). In an attempt to individualize skills building opportunities for every student, the variety of learning materials used will be much greater that previously used within the class (i.e., instead of utilizing a single graded standard assignment for all students to complete, the students will be allowed to select a personalized presentation of the material to critique and utilize in future studying). Currently, many use this immersive, student driven teaching trend in learning and allow for student centered presentations, projects, etc. in an attempt to increase student engagement and interest (Odom & Bell, 2015; Stefaniak & Tracey, 2015; Westberry & Franken, 2015). Wilson, Hu, Basham and Campbell (2015) predict a rising trend in the type of student centered learning integral to self-regulation "in which the learners not only choose what to learn but also choose how and why that topic is

learned" (p. 1194). Central to this is Dana & Yendol-Hoppey's assertion that "good and ethical teaching involves asking student's questions about their learning to ascertain their understanding of content to inform instructional decisions that will ensure successful learning opportunities for all" and the observation of "behavior that provides insights into students' acquisition of knowledge and understanding" (2014, p. 148).

The participant-researcher will pool the data used within this research and will maintain confidentiality, anonymity and adhere to the protection of student information under the Family Educational Rights and Privacy Act (FERPA), for which the participant researcher participates in yearly training. Upon conducting this research, it is the ethical obligation of the researcher to make students aware of the voluntary nature of their participation in surveys or use of any comments. The survey in use will provide information about the use of the data and a waiver for use of the information. Students and instructors will be informed of the anonymity guaranteed in the use of their responses, via the use of pseudonyms, and will be asked to read a waiver at the top of the survey allowing for the specific use of written comments within the presentation of this research (See Appendix B).

As always, researcher bias must be taken into account. All efforts to maintain honesty, fairness, and uniformity will be made to validate the opinions and that data collected as unbiased. The participant-researcher also feels that the role of this study is mainly to ensure that students benefit from the information gained. Because of this, she feels it is only fair to anonymously share with students, some of the "best practices in studying" that are observed in their more successful peers, just as instructors share best practices in teaching.

Acting. Mertler (2014) identifies the second stage in the cyclic cycle of action research as the acting stage. This stage includes implementing the intervention, collecting, and analyzing data. During this action research, quantitative data will be collected and statistical analysis of the data will be used to gage the impact of the SRSB Assignments on self-regulatory ability as accurately as possible.

Sample. The goal of action research is to provide data and results for the researcher that is taking the action. As action research is meant to be relevant to the participants, without generalization being a concern, the sample used in the research is meant to provide the context for the study. The students within my Introductory Biology classroom will provide the sample for this study. Due to the nature of college course enrollment, there is no ability to randomize the students. Therefore, the participant-researcher will rely on convenience sampling for this study sample.

***Data Collection and Procedures*.** The action research methodology for this study is designed to analyze the implementation of the SRSB Assignment Model at a southern community college. The students at the college will be enabled to self-evaluate their learning and formulate a self-reaction though this Model. To determine student's initial abilities to self-regulate, each student will be asked to complete a modified version of the *Motivated Strategies for Learning Questionnaire* (MSLQ) (Pintrich & DeGroot, 1990; Pintrich, Smith, Garcia, & McKeachie 1991; Pintrich et al., 1993) that has shown to provide a reliable measure of student's ability to self-regulate (Jacobson & Harris, 2008; McClendon, 1996). The MSLQ is designed to assess students' motivational beliefs (task value, self-efficacy, and test anxiety) and self-regulation (metacognitive self-regulation and time management). Because the focus of this study is students' self-regulatory

ability, the motivational beliefs portion of the MSLQ will be omitted. The MSLQ is a widely used survey that utilizes a 7-point Likert scale (1 = not at all true of me and 7 = very true of me) to evaluate student motivation and learning strategies by college students. Upon completion of the intervention, the students will be asked to complete the MSLQ questionnaire a second time to assess any changes in their abilities and/or attitudes toward self-regulation and study habits related to the Introductory Biology course at the College.

The first component of the intervention, to be assigned on the first day of class, is the completion of the VARK (Visual, Aural, Read/Write, and Kinesthetic) Assessment and a self-analysis of the results. Fleming and Mills first introduced the VARK Assessment in 1992. The pair set out to design a facilitative survey meant to increase student focus and directedness, asserting that the mechanism used needed to be more than a "simple diagnostic tool, we wanted something that would serve as a catalyst for discussion and debate and encourage students to collaborate in the process" (Fleming & Mills, 1992, p. 139). The awareness created with the VARK Analysis is designed to initiate student metacognition. Students that critique the analysis appropriately, do so with self-reflection and often utilize the information to their benefit. This individualization of learning styles and personalized approach to the SRSB assignments leads to a cache of student-acquired resources to meet almost every individual learning preference.

The intervention being used is referred to as the Self-Regulation Skills-Building (SRSB) Assignment Model, which students will be assigned as the weekly lecture review at the end of each subsequent week of instruction. The SRSB Assignments will be used

for the first two units of instruction, which is comprised of the first six weeks of the semester.

The SRSB Assignments will be administered online as part of the Introductory Biology course. After each week of instruction, students will be asked to complete an SRSB Assignment. The SRSB Assignments will be added to the school's learning management system where students will be prompted to individually address the following prompts:

1. Review your notes and identify one concept, term, or process from this week's lecture that you have had difficulty with, do not understand, or feel you need to dedicate more study time to in order to succeed on the test.
2. Find and share a resource (website, game, video, image, worksheet, etc.) or study technique that you feel addresses the difficult concept from the prompt above. Include information on why you chose this particular resource or study technique.
3. Describe how you plan to use this resource/technique to better understand or master the difficult concept. Be reasonable with your plan and take your other obligations (work, other classes, family time, etc.) into consideration. Include in your plan:
    a. what you will do with the resource you've chosen/how you plan on using this resource,
    b. the amount of time you will need to complete this task and when you plan on setting aside that time in your schedule, and

c. the number of repetitions you plan to use (i.e. how many times will you perform this task per day or per week)

4. Describe how you plan to test your understanding of the concept upon completion of your plan. Consider how you will know if your studying worked and that you will ultimately need to be able to answer test questions about this concept.

The answers to the SRSB Assignment will be graded using the rubric included as Appendix C. The instructor will provide detailed feedback and suggestions to the students' individual self-evaluation and answers to the questions above. The feedback will be tailored toward positive reinforcement and encouraging students to follow through on the plans that they have devised (question 3 and question 4 responses).

Upon completion of the second instructional unit, the students will be asked to again complete the modified MSLQ and data from the questionnaires will be analyzed.

***Statistical Analysis*.** The quantitative nature of this study will allow for the use of both descriptive and inferential statistics in the analysis of the study data. Descriptive statistics will allow for the general description of the data including central tendencies and distributions of both the pretest and posttest data. The mean will be used to calculate central tendency, but will use the median if the data is skewed. Graphical analysis and calculating these descriptive statistics will aid in describing the data as an accurate representation changes in the students' abilities to self-regulate based upon the MSLQ data.

The inferential statistics are used to help in determining the impact of the Self-Regulation Skill-Building Assignments on the students' ability to self-regulate. A

repeated measure t-test will be used to determine the differences in pretest and posttest means in reference to responses on the MSLQ. This analysis will determine if there is a statistical difference in the self-regulatory ability of the students before and after the SRSB Assignments.

Developing. Mertler (2014) identifies the third stage of action research as the developing stage and describes it as the ultimate goal of an action research study. The data generated by this action research study will be used as part of a practical plan to increase student self-regulation. For example, if the study shows that the Self-Regulation Skill-Building Assignments are successful in increasing the self-regulatory abilities of students, a plan will be constructed to use the SRSB assignments in concert with other interventions to increase pass and retention rates for the Introductory Biology course. The participant-researcher will also use the data from this study to inform her personal instructional habits in future courses.

Reflecting. In Mertler's (2014) fourth and final stage of action research, he impresses upon the reader the importance of methodical reflection upon the participant-researcher's practices. This is an integral part of the action research process because this is the point at which the researcher evaluates the effectiveness of the intervention and makes decisions about alterations that could influence future cycles of the research. Ruth Leitch and Christopher Day (2000) summarize the three main goals of reflective practice:

1. As teaching and learning are "complex practices," there is not a singular method or mechanism considered *best*; therefore, consideration of multiple practices, both past and future, will likely lead to improvement.

2. Reflective practice promotes self-challenge and self-knowledge, leading to personal development
3. Self-reflective practices encourage collaboration, leading researchers to consider themselves as active participants in the educational process and not someone filling the role of disseminating conserved practices and theories. (p. 182)

The reflection period will allow time to address how effective the research was at answering the research question, the appropriateness of the research design and statistical analysis, was the data collection sufficient, and whether the study revealed any questions or topics to be addressed in future studies. Reflection on the research will allow for important changes that will aid in strengthening the data and conclusions (Mertler, 2014).

The reflection stage is also when researchers have the opportunity to share their findings. Although action research is not designed to be generalized, formal or informal sharing will help connect the application to the research, especially for those that are teaching within the same context. If the introduction of the Self-Regulation Skill-Building Assignments proves beneficial at increasing the self-regulatory ability of the students, it is my goal to have the assignments become a regular addition to the Introductory Biology curriculum. The participant-researcher would also welcome the chance to aid other instructors in extending the SRSB assignment premise to other courses at the college.

Summary and Conclusion

Many Introductory Biology students display poor self-regulatory abilities, which lead them to struggle in the course. This action research study aims to discover the impact

of the Self-Regulation Skills-Building Assignment Model on the self-regulatory ability of students. The research question guiding this study is: What is the impact of the Self-Regulation Skill-Building Assignment Model on students' ability to self-regulate? The participant researcher hopes to answer this question via Mertler's (2014) action research cycle: *planning, acting, developing,* and *reflecting*. The *planning* stage involves using personal and professional experiences to identify a problem of practice and narrowing the topic of interest via research and then exploring possible pathways toward completing the research. The second stage, *acting,* includes implementing the intervention, collecting, and analyzing data. The *developing* stage uses the data analysis from the acting stage to create a plan for improvement. The final stage in the action research cycle, reflection, will involve self-analysis of both the research question and the methodologies. It is also typical to share the results of the action research in the *reflection* stage. Improvements or modifications deemed necessary by the *reflection* stage would move the action research back to the first stage for subsequent action research.

CHAPTER FOUR: FINDINGS AND INTERPRETATIONS OF RESULTS

Introduction

Chapter Four includes the findings and implications of the findings for the present action research study, including data analysis techniques, an evaluation of the results of the study, an analysis of the data, and a conclusion. The chapter begins with a brief overview of the identified problem of practice, research question, and the purpose of the research. The participant-researcher implemented an intervention intended to improve self-regulation among Introductory Biology students. The general goal of the study was to determine the effects of the Self-Regulation Skills-Building (SRSB) Assignment Model upon students in Introductory Biology Courses at Central Southern Technical College.

Problem of Practice

Introductory Biology students at CCTC struggle for course success due to an inadequate ability to self-regulate. Consistent interaction with students allows the participant-researcher to note that many students display poor self-regulatory abilities, which cause them to struggle in the course. Often, students do not experience course success because of their poor time management skills, lack of self-reflective behaviors, and a failure to correct unsuccessful habits. As college learning is a shift from the traditional instructor-regulated learning that takes place in much of K-12 education, there is a greater need for self-regulation in order to successfully navigate the coursework. The data collected is representative of students' self-determined ability to self-regulate,

specifically in reference to metacognitive self-regulation and time management. The *Motivated Strategies for Learning Questionnaire* (MSLQ) (Pintrich & DeGroot, 1990) has shown to provide a reliable measure of student's ability to self-regulate and gains scores will be analyzed after the implementation of the intervention.

Purpose Statement

The identified purpose of this Action research is to evaluate the impact of introducing Self-Regulation Skills-Building (SRSB) Assignments on student's ability to self-regulate in the Introductory Biology course at Central Southern Technical College. More specifically, the research will measure the impact of the SRSB Assignments on student's self-regulatory abilities via the Motivated Strategies for Learning Questionnaire (MSLQ). The SRSB Assignment model prompts students to pinpoint weaknesses in content knowledge while still allowing them autonomy in their selection of study tools and techniques. The aim of the SRSB assignment is to increase the study skills of the students by aiding them in developing personalized study skills and by increasing students' self-confidence during assessments. In general, this study will also outline the mechanisms used to prompt students to develop personalized study techniques and assess the impact of this intervention on student perceptions of their study techniques and abilities to self-regulate.

Research Question

What is the impact of the Self-Regulation Skill-Building Assignment Model on students' ability to self-regulate?

Findings of the Study

This section describes the participants in this quantitative action research study, the data collection methods employed by the participant-researcher, data analysis of the study, and the findings of the study. Interpretations of the results are included in the subsequent section of the study.

Participants

The present action research took place in two Introductory Biology courses at Central Southern Technical College, a southern technical college with an enrollment of 3718 students in the Fall of 2017. Introductory Biology courses are taught as a hybrid course in which students are responsible for an instructor designated portion of the course online and meet for 80 minutes twice a week. The SRSB intervention was applied to the first 8 weeks of the course and data collection via the Motivated Strategies for Learning Questionnaire (MSLQ) was performed during the first two weeks of the course and after the completion of the final SRSB intervention. In total, 19 students completed the pretest and the posttest MSLQ.

Data was collected in the Fall Semester of 2017 among two Introductory Biology courses (n=46) at Central Southern Technical College in South Carolina. During the first week of class, students were asked to complete an anonymous use consent form (see Appendix C) and the MSLQ. Over the next eight weeks, students were tasked with completing 5 SRSB assignments, one for each chapter covered during that time frame.

Data Collection

The action research study followed a quantitative design, as suggested by Mertler (2014), in order to analyze the results of the study. During the first week of the 16 week semester, students in two Introductory Biology courses were asked to complete the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1993) The extended MSLQ assesses students' motivational as well as their self-regulatory ability and consists of over 80 questions. As time management has been deemed an issue for Introductory Biology students in the past, the participant researcher believes that it will be more effective and that more accurate data will be collected when using the abbreviated version of the MSLQ (Pintrich & DeGroot, 1990). The MSLQ being used has only 44 questions and measures motivational beliefs (self-efficacy, intrinsic values, and test anxiety) and self-regulated learning strategies (cognitive strategy use and self-regulation). The MSLQ is a widely used self-reporting measure that utilizes a 7-point Likert scale (1 = not at all true of me and 7 = very true of me) to evaluate student motivation and learning strategies by college students. The MSLQ will be administered a second time to the same group of students after the intervention in order to compare pretest/posttest scores. As the Introductory Biology course is considered a hybrid course and students are expected to participate online in various formats, the MSLQ will be administered via the college's learning management system (Desire2Learn/D2L).

The intervention used is referred to as the Self-Regulation Skills-Building (SRSB) Assignment Model, which students will be assigned as the weekly lecture review at the end of each subsequent week of instruction. The SRSB Assignments are a short set of self-reflective prompts that encourage student planning, monitoring, self-assessment, and

resource management. The SRSB Assignments will be used for the first two units of instruction and data was collected between August 2017 and October 2017.

The SRSB Assignments will be administered online as part of the Introductory Biology course. After each week of instruction, students will be asked to complete an SRSB Assignment. The SRSB Assignment (see Appendix A) will be added to the school's learning management system where students will be prompted to individually answer the questions and submit their assignment.

The answers to the SRSB Assignment were graded using the rubric included as Appendix B. Detailed feedback was provided to each student based upon his or her answers to the SRSB. The feedback was tailored toward positive reinforcement and encouraging students to follow through on the plans that they have devised (question 3 and question 4 responses to the SRSB Assignment).

The Collection Instrument

The Motivated Strategies for Learning Questionnaire (MSLQ) was developed by Pintrich, Smith, Garcia, and McKeachie (1991) to assess college students' motivational orientations and their use of different learning strategies. In its whole, it is an 81 item, self-reporting instrument consisting of two broad sections, one dedicated to assessing motivation and another to assess students' self-regulatory abilities. The abbreviated version being used for this study removes some of the constructs that are less relevant to the problem of practice. For example, the 44 question abbreviated version removes the measurement constructs of task value and extrinsic goal orientation. Artino (2005) notes that some of the constructs measure by the MLSQ are "notoriously difficult

to assess," lending credence to the use of the most commonly used and validated version of the MSLQ (p. 11).

The MSLQ asks students to self-report, rating themselves on a 7-point Likert scale, from 1 (not at all true of me) to 7 (very true of me). Scores for the individual subscales are calculated by taking the mean of the items within that particular subscale. For example, the *Cognitive Use* subscale has 13 items. A few items within the MSLQ are considered "reversed" and are worded negatively, so the scale/score must be reversed in order to correctly calculate the score for those items (Pintrich et al., 1991). Post reversal, the overall score for a given subscale represents the positive wording of all items within that scale and so higher scores indicate greater levels of the construct being measured (Duncan & McKeachie, 2005).

"The social-cognitive theoretical framework on which the MSLQ was founded assumes that motivation and learning strategies are not traits of the learner, but rather that motivation is dynamic and contextually bound and that learning strategies can be learned and brought under the control of the student" (Duncan & McKeachie, 2005, p. 117). This means allows the MSLQ can be used as a tool to assess changes in student learning strategies and motivation. The MSLQ will be utilized as a pre- and posttest component of the study to determine the effect of the SRSB on students' motivation and self-regulatory ability. The gains scores (gains = posttest – pretest) were calculated for each student and means were determined to ascertain the effectiveness of the SRSB modules.

To ensure validity of the instrument, correlational studies were "carried out on over 2,000 students during the 5 years of funding for the National Center for Research to Improve Postsecondary Teaching and Learning" and were considered to "have shown

fairly consistent results," in which the researchers found that "students who use more deep-processing strategies such as elaboration and organization and who attempt to control their cognition and behavior through the use of metacognitive planning, monitoring, and regulating strategies are more likely to do better in their course assignments, exams, and papers as well as overall course grade" (Duncan & McKeachie, 2005). Pintrich et al. (1991) found the MSLQ to have predictive value for teachers and students in that "the scale correlations with final grade are significant, albeit moderate, demonstrating predictive validity" (Pintrich et al., 1991, p. 7). The MSLQ has been used by hundreds of researchers and instructors worldwide and has been translated into several languages, the reliability and usefulness of the MSLQ as a motivation and learning-strategies assessment has been repeatedly reinforced (see Duncan & McKeachie, 2005 for a list of empirical studies employing the MSLQ).

In terms of validity, the biggest threats are probably correlated with the MSLQs use of self-reporting to collect data. Social desirability bias is considered a significant threat to the construct validity of all self-report instruments as the want of students to be viewed favorably is a common desire. The authors of the MSLQ have found that measures of response bias did not account for any significant amount of variance and did not change their final results (Duncan & McKeachie, 2005, p. 124).

Data and Analysis

The MSLQ is divided into five sections that were analyzed individually to look for overall changes in students' self-perceived metacognitive and cognitive learning strategies. These categories include: Cognitive strategy use, Intrinsic (task) value, Self-efficacy, Self-regulation, and Test anxiety.

Cognitive Strategy Use

The Cognitive Strategy Use section consists of 13 items addressing students' use of rehearsal strategies (e.g., question 34 " When I study for a test I practice saying the important facts over and over to myself"), elaboration strategies such as summarizing and paraphrasing, and organizational strategies. Upon completion of the intervention, a paired t-test was used to compare the pretest MSLQ self-reported values to the posttest MSLQ self-reported values. There was a statistical difference found between the pretest MSLQ means (M= 5.506085, SD = 0.998503) and the posttest MSLQ means (M= 5.700392, SD = 0.933727); t = 3.0893, p = 0.0094. Figure 4.1 graphically represents the mean responses for the Cognitive Strategy Use questions. The calculated p-value below 0.05 (p=0.0082) indicates a significant difference between the means of the pretest and posttest self-reported answers in regards to Cognitive Strategy Use (Table 4.1).

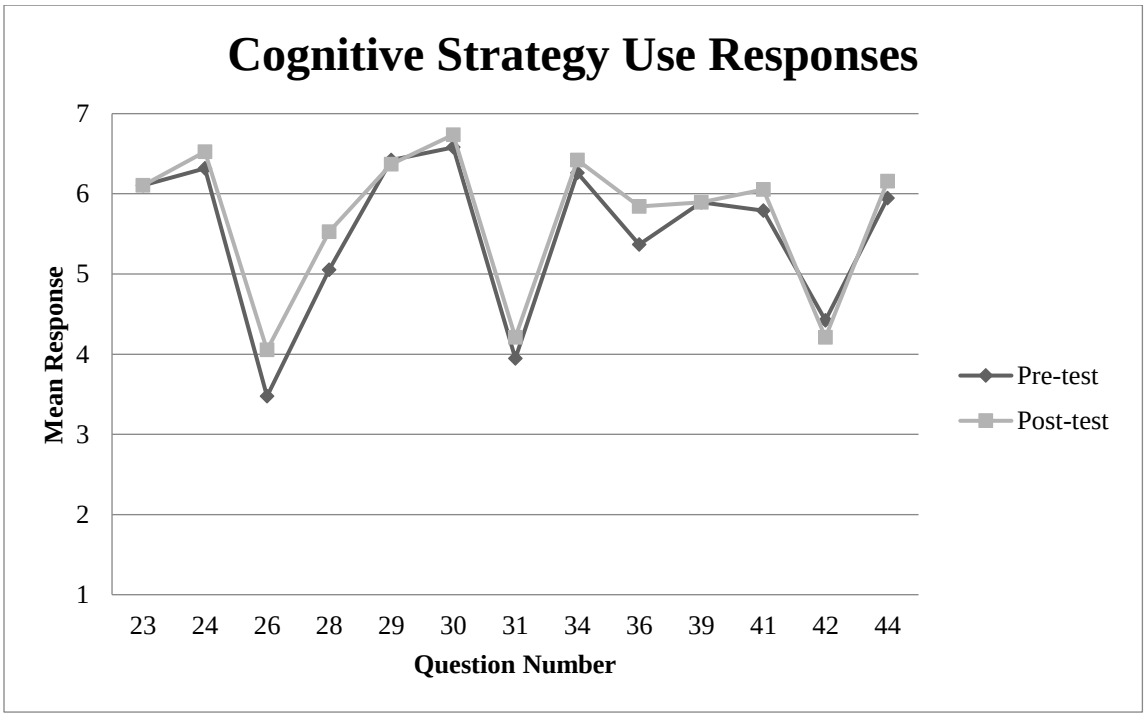

Figure 4.1 Mean pretest responses compared to the mean posttest responses for the Cognitive Strategy Use questions of the MSLQ.

Table 4.1 Means of Self-Reported Answers to Cognitive Strategy Use Questions

Question Number	Question Content	Pretest Mean	Posttest Mean	Gain
23	When I study for a test, I try to put together the information from class and from the book	6.1053	6.1053	0.0000
24	When I do homework, I try to remember what the teacher said in class so I can answer the questions correctly	6.3158	6.5263	0.2105
26	It is hard for me to decide what the main ideas are in what I read (R)	3.4737	4.0526	0.5789
28	When I study I put important ideas into my own words	5.0526	5.5263	0.4737
29	I always try to understand what the teacher is saying even if it doesn't make sense.	6.4211	6.3684	-0.0526
30	When I study for a test I try to remember as many facts as I can	6.5789	6.7368	0.1579
31	When studying, I copy my notes over to help me remember material	3.9474	4.2105	0.2632
34	When I study for a test I practice saying the important facts over and over to myself	6.2632	6.4211	0.1579
36	I use what I have learned from old homework assignments and the textbook to do new assignments	5.3684	5.8421	0.4737
39	When I am studying a topic, I try to make everything fit together	5.8947	5.8947	0.0000
41	When I read materials for this class, I say the words over and over to myself to help me remember	5.7895	6.0526	0.2632
42	I outline the chapters in my book to help me study	4.4211	4.2105	-0.2105
44	When reading I try to connect the things I am reading about with what I already know	5.9474	6.1579	0.2105

Intrinsic Value

The Intrinsic Value scale includes nine questions that are used to assess student interest in and the perceived importance of a course. There was no statistical difference found between the pretest MSLQ means (M= 5.9942, SD = 0.8336) and the posttest MSLQ means (M= 5.8947, SD = 0.7789) for the Intrinsic Value responses; t = 1.4457, p = 0.1862. Figure 4.2 graphically represents the mean responses for the Intrinsic Value questions. The calculated p-value that is well above 0.05 (p=0. 1862) indicates that there is no difference between the means of the pretest and posttest self-reported answers in regards to the Intrinsic Value response means (Table 4.2).

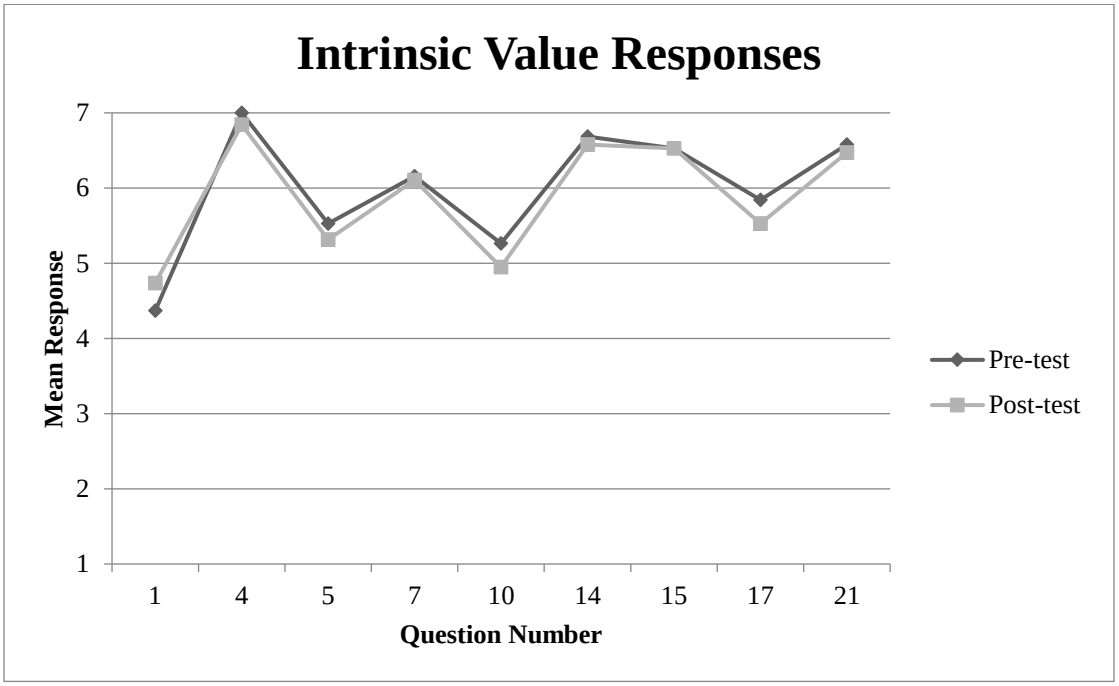

Figure 4.2 Mean pretest responses compared to the mean posttest responses for the Intrinsic Value questions of the MSLQ.

Table 4.2 Means of Self-Reported Answers to Intrinsic Value Questions

Question Number	Question Content	Pretest Mean	Posttest Mean	Gain
1	I prefer class work that is challenging so I can learn new things.	4.3684	4.7368	0.3684
4	It is important for me to learn what is being taught in this class	7.0000	6.8421	-0.1579
5	I like what I am learning in this class	5.5263	5.3158	-0.2105
7	I think I will be able to use what I learn in this class in other classes	6.1579	6.1053	-0.0526
10	I often choose paper topics I will learn something from even if they require more work	5.2632	4.9474	-0.3158
14	Even when I do poorly on a test I try to learn from my mistakes	6.6842	6.5789	-0.1053
15	I think that what I am learning in this class is useful for me to know	6.5263	6.5263	0.0000
17	I think that what we are learning in this class is interesting	5.8421	5.5263	-0.3158
21	Understanding this subject is important to me	6.5789	6.4737	-0.1053

Self-Efficacy

The Self-Efficacy scale includes nine questions that address students' self-confidence and competence in regards to performance in the class. The difference between the pretest MSLQ means (M= 5.7485, SD = 0.7644) and the posttest MSLQ means (M= 5.5263, SD = 0.7762) was found to be statistically significant; t = 2.9695, p = 0.0179. Figure 4.3 graphically represents the mean responses of the Self-Efficacy questions. The calculated p-value that is below 0.05 (p=0. 0179) indicates that there is a statistical difference between the mean responses to the pretest and posttest Self-Efficacy questions (Table 4.3). Interestingly, the trend for the self-efficacy questions seems to be a decrease in the students' mean responses.

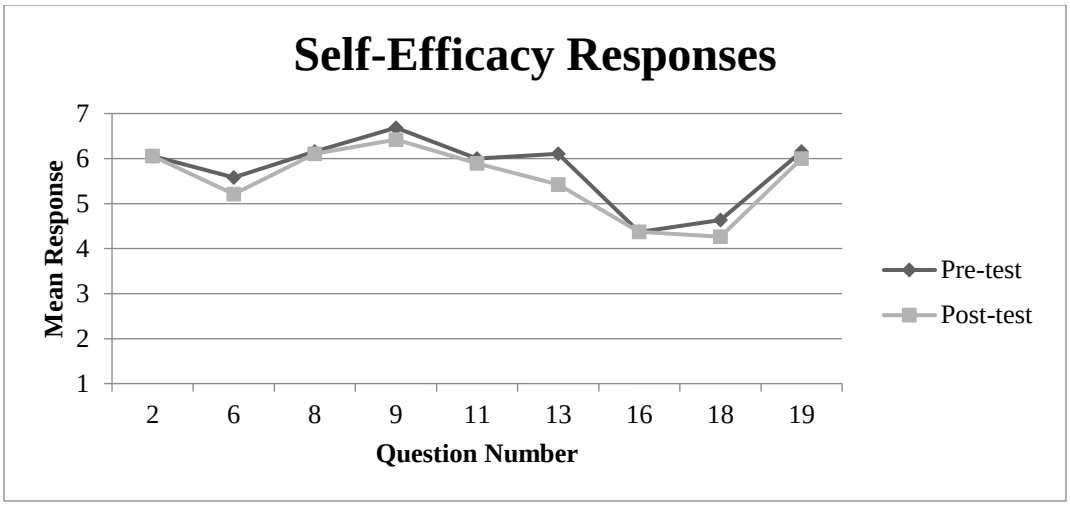

Figure 4.3 Mean pretest responses compared to the mean posttest responses for the Self-Efficacy questions of the MSLQ.

Table 4.3 Means of Self-Reported Answers to Self-Efficacy Questions

Question Number	Question Content	Pretest Mean	Posttest Mean	Gains
2	Compared with other students in this class I expect to do well	6.0526	6.0526	0.0000
6	I'm certain I can understand the ideas taught in this course	5.5789	5.2105	-0.3684
8	I expect to do very well in this class	6.1579	6.1053	-0.0526
9	Compared with others in this class, I think I'm a good student	6.6842	6.4211	-0.2632
11	I am sure I can do an excellent job on the problems and tasks assigned for this class	6.0000	5.8947	-0.1053
13	I think I will receive a good grade in this class	6.1053	5.4211	-0.6842
16	My study skills are excellent compared with others in this class	4.3684	4.3684	0.0000
18	Compared with other students in this class I think I know a great deal about the subject	4.6316	4.2632	-0.3684
19	I know that I will be able to learn the material for this class	6.1579	6.0000	-0.1579

Test Anxiety

The Test Anxiety scale includes four questions that address student concerns about test taking in regards to their cognitive ability (e.g., question three which states, "I am so nervous during a test that I cannot remember facts that I have learned"). The difference between the pretest MSLQ means (M= 4.592100, SD = 0.310987) and the posttest MSLQ means (M= 4.486850, SD = 0.415277) was not found to be statistically significant; t = 0.6271, p = 0.5751. Admittedly, the sample size for a t-test of for differences between the means is very small but the gains scores seem to support this assertion (Table 4.4). Figure 4.4 graphically represents the mean responses for the Test Anxiety questions of the MSLQ.

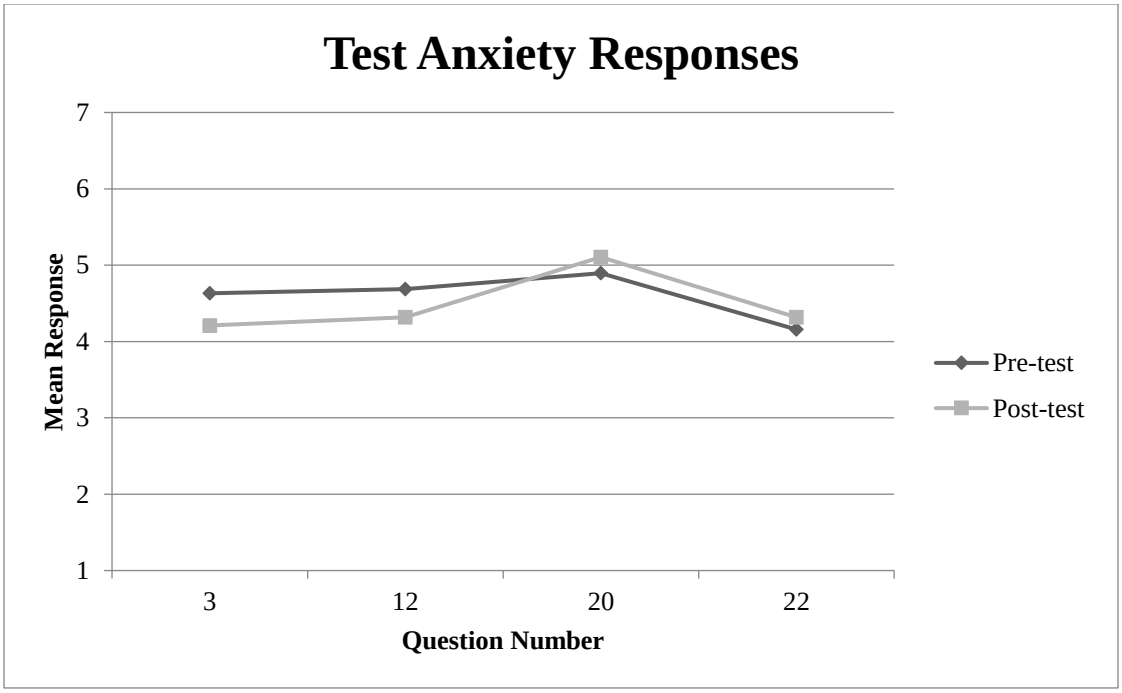

Figure 4.4 Mean pretest responses compared to the mean posttest responses for the Test Anxiety questions of the MSLQ.

Table 4.4 Means of Self-Reported Answers for the Test Anxiety Questions

Question Number	Question Content	Pretest Mean	Posttest Mean	Gain
3	I am so nervous during a test that I cannot remember facts I have learned	4.6316	4.2105	-0.4211
12	I have an uneasy, upset feeling when I take a test	4.6842	4.3158	-0.3684
20	I worry a great deal about tests	4.8947	5.1053	0.2105
22	When I take a test I think about how poorly I am doing	4.1579	4.3158	0.1579

Self-Regulation

The Self-Regulation scale includes nine questions that address students' self-confidence and competence in regards to performance in the class . This includes the students' ability to monitor learning, assess knowledge, and make necessary changes to adapt to their current learning needs. The difference between the pretest MSLQ means (M= 5.087711, SD = 1.156686) and the posttest MSLQ means (M= 5.380122, SD = 0.940692) was found to be not quite statistically significant; t = 1.9275, p = 0.0901. Figure 4.5 graphically represents the mean responses of the Self-Efficacy questions. The calculated p-value above 0.05 (p=0. 0901) indicates that there is not a statistical difference between the mean responses to the pretest and posttest Self-Regulation questions (Table 4.5).

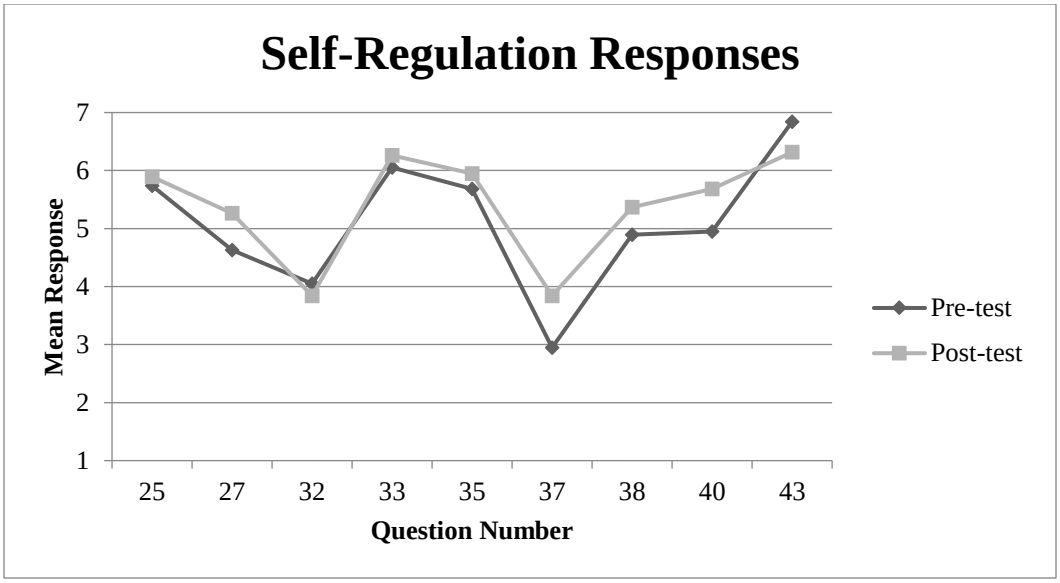

Figure 4.5 Mean pretest responses compared to the mean posttest responses for the Self-Regulation questions of the MSLQ.

Table 4.5 Means of Self-Reported Answers for the Self-Regulation Questions

Question Number	Question Content	Pretest Mean	Posttest Mean	Gain
25	I ask myself questions to make sure I know the material I have been studying	5.7368	5.8947	0.1579
27	When work is hard I either give up or study only the easy part	4.6316	5.2632	0.6316
32	I work on practice exercises and answer end of chapter questions even when I don't have to	4.0526	3.8421	-0.2105
33	Even when study materials are dull and uninteresting, I keep working until I finish	6.0526	6.2632	0.2105
35	Before I begin studying I think about the things I will need to do to learn	5.6842	5.9474	0.2632
37	I often find that I have been reading for class but don't know what it is all about (R).	2.9474	3.8421	0.8947
38	I find that when the teacher is talking I think of other things and don't really listen to what is being said	4.8947	5.3684	0.4737
40	When I'm reading I stop once in a while and go over what I have read	4.9474	5.6842	0.7368
43	I work hard to get a good grade even when I don't like a class	6.8421	6.3158	-0.5263

Interpretations of the Results of the Study

While it was determined that the SRSB Assignments had no statistically significant affect upon the self-regulation of students in the Introductory Biology courses. It was found to have a statistically significant, positive influence on the student's cognitive strategy use. Unfortunately, there was also found to be a statistically significant, negative response in the students' self-reporting of their self-efficacy.

Conclusion

The primary research question "*What is the impact of the Self-Regulation Skill-Building Assignment Model on students' ability to self-regulate*?" drove the data collection in this study via the MSLQ. Implications of the data collected suggest that the SRSB Assignments intervention designed by the participant researcher does not increase the self-regulation ability of Introductory Biology students. However, the data does suggest that the student did improve their cognitive use strategies when studying for the course. As many students would repeat habits that they deemed successful on multiple SRSB Assignments, this comes as no surprise when analyzing the data. The decrease in self-efficacy was not unexpected as most students will not understand the rigors associated with the course at the time of the pretest MSLQ administration.

CHAPTER FIVE: DISCUSSION AND FUTURE DIRECTIONS

Introduction

Chapter Five will summarize the findings of the present action research study designed to ascertain the effects of the Self-Regulation Skills Building (SRSB) Assignment Model on two classes of students in an Introductory Biology course at Central Southern Technical College. The SRSB Assignment Model was designed by the participant researcher after extensive research on self-regulation and mechanisms designed to enhance self-regulation with the expressed intent to increase student self-regulation before he or she moves on to a more demanding biology course at the college. The research focused on the identified problem of practice, which stems from participant-researcher's observations of the difficulty students have transitioning from a secondary to a postsecondary learning environment, specifically the students' lack of self-regulatory skills, in concert with the nuances and difficulties associated with science learning. The participant-researcher focused on the following research question: What is the impact of the Self-Regulation Skill-Building Assignment Model on students' ability to self-regulate in an Introductory Biology course?

The high percentage of first-time college students, as well as first generation college students, that populate technical and community colleges establishes a unique learning environment. As these students often struggle with the transition from secondary to post-secondary education, their lack of self-regulatory skills becomes

apparent in higher than normal attrition rates and lack of persistence. As Nordell (2009) explains, students often become frustrated with the material due to a lack of instructor facilitated learning and when a high dependence of self-regulation is necessary these students will often achieve below their potential in a course. As Introductory Biology courses are designed to familiarize students with scientific thinking, terminology, and basic skills, their existence within a curriculum provides instructors with the opportunity to implement interventions that prepare students for the rigors of higher level coursework via the enhancement of their self-regulatory abilities. Chapter Five will provide an overview and summary of the study and then a description of an action plan regarding future interventions to enhance self-regulation among first semester biology students is provided. The Chapter concludes with suggestions for future research.

Results and Summary of the Research

The data from this action research was gathered in the Fall Semester of 2017, via a pretest-posttest design using the Motivated Strategies for Learning Questionnaire (MSLQ). The SRSB Assignment intervention was assigned to students weekly for the first 2 units of instruction (the first six weeks of the course). Averages of the self-reported responses to the MSLQ were calculated from students that responded to the MSLQ both before and after the intervention and a pretest-posttest comparison of the scores was calculated via paired t-test. Responses to the MSLQ can be disaggregated into five categories: Cognitive strategy use, Intrinsic (task) value, Self-efficacy, Self-regulation, and Test anxiety. A discussion of each of these themes and the results of the pretest-posttest analysis are included below.

Cognitive Strategy Use. Cognitive strategy use includes both simple and complex strategies for information processing, including but not limited to students' use of rehearsal (e.g. memorization and recall strategies), elaboration (e.g. summarizing and elaboration), and organization (e.g. outlining or the construction of tables and charts). Simple strategies such as listing points or memorizing serve to activate information in the student's working memory while more complex cognitive strategies like elaboration "help the learner integrate and connect new information to prior knowledge (Pintrich et al., 1991, p. 20). An overall increase was seen in the responses to the questions designated as assessing cognitive use strategies and the paired t-test analysis found those differences to be statistically significant ($p=0.0082$). As cognitive strategies are an important part of being able to plan, monitor, and regulate their learning, a statistically significant increase in their use among students after the implementation of the SRSB Assignment intervention should, by extension, benefit those students' overall class performance.

Intrinsic Value. Intrinsic value, also described as task value, questions of the MSLQ assess how interesting students find the information at hand. This includes an assessment of how important or useful the task is considering the future goals of the students. While there is a marginal negative trend when comparing the pretest and posttest means for the questions that assess intrinsic value, statistical analysis shows that there was not significant change in how students valued the information in the course ($p = 0.1862$). The overall responses indicate that students seem to positively value the information in the course and recognize its applicability both before and after the intervention.

Self-Efficacy. The Self-Efficacy scale measures two aspects of students' expectancy: the student's expectations of success and self-efficacy, or how the student appraises his or her ability to master a task. In many ways this includes a self-assessment of the student's confidence level based upon how well they perceive their ability to perform in the class. Comparison of the MSLQ responses before and after the intervention includes statistically significant (p=0. 0179) evidence of a negative trend. In other words, students seem to have become less confident about their abilities in the class when they completed the MSLQ at the end of the six week intervention period.

Considering the observed trend of the first unit's material being the most difficult to master and that the accompanying test as one with the lowest class average, this is not surprising. Communications with many of the students at the beginning of the semester allowed the participant-researcher to know that many felt as if they were not as prepared for the course as they first thought and that they knew they needed to make some changes in order to be successful in the course. For many of these students, the poor grades were out of the norm from what they were used to and their pre-intervention responses to the MSLQ could be considered naïve.

Test Anxiety. Self-reported measurements from the MSLQ regarding test anxiety showed no statistically significant increase or decrease post-intervention (p = 0.575). As negative feelings about the completion of an exam are often correlated with poor performance on exams, changes in this measure would indicate how the intervention impacts the students' confidence levels and comfort with the material. Whitaker, Sena, Lowe, and Lee (2007) assert that individuals that experience test anxiety experience physical and psychological reactions that trigger negative feelings that compromise their

abilities during testing. Luckily, the pretest-posttest comparison did not reveal an increase in the amount of test anxiety that the students felt after the implementation of the SRSB assignment.

Self-Regulation. As the focus of the study, metacognitive self-regulation was one of the aspects in which the participant-researcher was most interested. As stated, self-regulatory activities include: planning, monitoring, and regulation (Pintrich et al., 1991). Planning activities are those that are designed to active prior knowledge in order to make organizing and comprehending the information easier. Monitoring activities are used to track one's progress toward a goal and can include activities like self-testing. Regulation, which is linked to monitoring, refers to the adjustments in cognitive activities that one makes based upon the results of one's monitoring. Regulation activities encompass those that individuals do in order to check and correct his or her performance on a task. Analysis of the average pretest and posttest responses to the MSLQ indicate that there is no significant difference in the amount of self-regulation that students use after the implementation of the intervention.

Implications of the Research

Review and consideration of the current study and its findings lead to the recommendation that instructors in introductory courses or those that include a large number of first time college students should consider using interventions that are designed to enhance students' metacognitive skills. The Introductory Biology students' self-reported lack of confidence in their study skills, previous knowledge of the material, and ability to extract information from the course readings imply that self-regulation and autonomous learning should be addressed in K-12 education. Efforts to do so would

likely increase student competence and mastery of the material in early college science learning. While the intended intervention designed to increase self-regulation was not successful among this set of students, the increase in cognitive strategy use is bound to have a positive effect upon student outcomes.

Action Research Plan

The results of this study indicate that the SRSB Assignment intervention is successful in increasing some aspects of metacognitive learning, specifically cognitive strategy use, but, in this study, its use was not found to enhance student self-regulation. The implementation of the SRSB Assignments in the class allowed the participant-researcher to provide students with individualized feedback based upon his or her self-described needs. Educational action research provides the participant-researcher with more information about how the students in the class learn and how they are impacted by the interventions put in place within the course. Even in instances where there was not statistically significant increase or decrease in students' responses, the information provided by the answers to the MSLQ is relevant in the way students perceive the course, their approaches to studying the material, and their levels of confidence. Mertler (2014) asserts that the development of an action plan should be the "ultimate goal of any action research study" as effectual teacher-researchers are most successful when they evaluate and reflect upon what they do (p. 43).

Review of the self-reported responses to the MSLQ reveals that students feel that they are underprepared when it comes to study skills and prior knowledge in the course (MSLQ questions 16 and 18), as well as difficulty extracting information from the course readings (MSLQ question 26), and choosing appropriate study techniques (MSLQ

questions 31 and 42). With this, and observations made during the administration of the SRSB Assignment that many students give broad or vague answers to questions about what they do not understand about the lecture, the participant-researcher feels that students have difficulty pinpointing the aspects of the lecture with which they need help. This hinders both the planning and monitoring stages of self-regulation as students are unable to plan or monitor without an assigned goal or task. This allows for the formulation of a new action research question: How does the inclusion of specific responses that reflect the learning goals of a chapter in the SRSB Assignment effect student self-regulation and cognitive strategy use?

Reflection upon the results of this study suggests that future interventions used to enhance self-regulation in students should include a choice of goals tailored very specifically to the chapter or unit being taught. While these could easily be described as chapter objectives, they will be more useful as part of a multi-part assignment like the SRSB Assignment and will be structured to reflect and individual student goal (e.g. "I have difficulty naming all four parts of Cellular Respiration in order" or "I have trouble remembering the difference between solutes, solvents, and solutions"). As independent goal setting (planning) seems to be a struggle for these students, this could help increase student monitoring and regulation in future courses.

In order to help students persist in future courses, the college has decided to do away with the Introductory Biology courses. The Introductory Biology requirement will be replaced with that of General Biology, a college transfer level course. While this course will retain many of the same elements and biological principles, it will be even more important for students to set learning goals as the material will be presented at a

greater depth and at a faster pace to include more biological concepts. Knowing this, future interventions will need to allow students a faster way to assess their knowledge and monitor progress toward mastery. This addition of prewritten learning goals could allow students more time to choose relevant resources and assess their learning.

As there are multiple instructors teaching the General Biology course, a first step within the action plan will be meeting with colleagues to discuss the transition and the best possible way to include specialized learning outcomes in the course. Schunk (2001) asserts that "Goals enhance self-regulation through their effects on motivation, learning, self-efficacy (perceived capabilities for learning or performing actions at given levels), and self-evaluations of progress (Bandura, 1997; Schunk, 1995)" (para. 4). As multiple instructors will be using these learning goals/objectives, it is appropriate for these instructors to be involved in the construction of these goals.

The participant-researcher will include the learning goals in the General Biology course that she teaches in the Fall 2018 semester and will encourage their use with other instructors in other sections. Comparing the course success and retention rates for students in the General Biology courses that use the instructor written goals to those that do not is a more accessible measure that can be acquired without the need for student self-reporting. The measure also allows for more data to be used and aligns with the retention goals for the college. While this will not speak directly to the construct of self-regulation, voluntary MSLQ data can be collected from students with the courses and can supply more data and direction after the department has acclimated to the changes associated with the removal of the Introductory Biology course.

Facilitating Educational Change

The teacher-researcher's action plan will facilitate positive change at CSTC. Collaboration with other instructors teaching the General Biology course will aid in the creation of a more student-centered learning environment. The development of the learning goals as a collaborative effort between the instructors and their availability to or use with the students will provide a shared understanding of the expectations of the course. Providing specific learning goals to students will alleviate the stresses and anxiety associated with planning and expectations.

The National Center for Education Statistics (NCES) (2017) finds that persistence levels of first-time college students in 2-year colleges and institutions to be 23 percent lower than those in 4-year colleges (57% and 80% respectively) (p. 2). It was also found that those first-time students at 2-year colleges represent an older population as 34 percent self-reported as being 20-years old or older upon their entry to college. Knowing that the dynamics of these students is very different than those of a typical 4-year college student, instructors, department chairs, and college leadership should consider implementing interventions that are specifically designed to facilitate learning among non-traditional student populations.

Action research similar to this stimulates both student and teacher learning. Exposing students to new techniques and directed interventions gives them a variety of learning opportunities that have been designed to enhance their academic performance and experience. Similarly, teachers are given the opportunity to disrupt the status quo by implementing practices that more closely align with their experiences with students and in the classroom. With this, action research enhances the academic environment and

moves schools and student toward the common end of securing the opportunity of a degree for all that are interested.

Suggestions for Future Research

As the results of this action research only apply to this select group of students, the participant researcher would like to know more about student experiences with other instructors and to have the opportunity to use the SRSB, with the modifications included above, during a semester with both a treatment and control group. As the intervention is intended to help students, the participant researcher feels some moral conflict with intentionally withholding the intervention from a group of students. Qualitative studies that make specific notations about themes within the students' choice of study aid in the SRSB Assignment would also be informative, as this information could be correlated with test grades and would provide insight into the most successful choices of students in Biology courses.

Conclusions

As the participant researcher observed many Introductory Biology students not meeting their potential in the course, the SRSB Model was designed and implemented in this action research in an attempt to increase student self-regulation as measured by the MSLQ. During this first cycle of the action research process, the participant-researcher found that the SRSB Assignment Model had no effect of self-regulation based upon the pretest-posttest comparison of MSLQ responses. There was, however, a statistically significant increase in student cognitive strategy use. Kauffman (2004) describes cognitive strategy use as "activities that support students' active manipulation of academic content" (p. 141). These would be the type of activities the participant-

researcher is referring to when referencing "study skills". While this is, obviously, not the only component necessary for student self-regulation, it is a major part of the problem of practice identified in this dissertation in practice.

A review of the literature concerning self-regulation, metacognition, and the current role of technical colleges in education lead to the inclusion of specific elements in the SRSB Assignment Model. Students were asked to complete the MSLQ questionnaire, created and validated by Pintrich et al. (1991) as a measure of self-regulation and metacognitive skills among students, both before and after the intervention. The instructor researcher then calculated average gains scores and performed statistical analysis in order to look for statistically significant differences in the pretest and posttest means. The results of this action research, while not completely in line with the expectations of the participant-researcher, add to the growing body of information regarding developmental instruction in technical colleges as well as interventions that influence student study skills and persistence.

Much was learned about student self-perceptions and how students feel about a course before beginning and after they have spent a few weeks working with the instructor and the material. It is the hope of the participant-researcher that this research will, at the very least, be used to raise awareness of the difficulty that first time Biology students face when transitioning to a college Biology course. A grander hope exists that the resulting action-plan and this action research will be used to enhance student study skills and to collaboratively create a set of goals that benefit both students and instructors at Central Southern Technical College.

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APPENDIX A: SELF-REGULATION SKILL-BUILDING ASSIGNMENT

Instructions: Review the content of this week's lecture and answer the following questions about the content that you found difficult and your plans to address that content through your studying. Answer all questions in complete sentences and include as much detail as possible. If you are using resources that can be found online, please include a link to your resources. I will review your answers and provide individual feedback to each answer.

1. Review your notes and identify one concept, term, or process from this week's lecture that you have had difficulty with, do not understand, or feel you need to dedicate more study time to in order to succeed on the test.
2. Find and share a resource (website, game, video, image, worksheet, etc.) or study technique that you feel addresses the difficult concept from the prompt above. Include information on why you chose this particular resource or study technique.
3. Describe how you plan to use this resource/technique to better understand or master the difficult concept. Be reasonable with your plan and take your other obligations (work, other classes, family time, etc.) into consideration. Include in your plan:
    a. what you will do with the resource you've chosen/how you plan on using this resource,
    b. the amount of time you will need to complete this task and when you plan on setting aside that time in your schedule, and
    c. the number of repetitions you plan to use (i.e. how many times will you perform this task per day or per week)
4. Describe how you plan to test your understanding of the concept upon completion of your plan. Consider how you will know if your studying worked and that you will ultimately need to be able to answer test questions about this concept.

APPENDIX B: SRSB GRADING RUBRIC

	Excellent	Progressing	Poor
Question 1: Identifying your weakness	Student identified at least one specific weakness from the lecture **(1 point)**	Student was not specific in addressing a weakness (i.e. "all of it," one word answers like "cells") **(0.5 points)**	Student did not address a weakness from the lecture **(0 points)**
Question 2: Identifying a resource	Student identified a resource/technique that is appropriate to the weakness pinpointed in Q1and explanation is included (**2 points)**	The resources/techniques are inappropriate to the weakness pinpointed in Q1 or there is no explanation of the choices **(1 point)**	Student did not identify any appropriate resources **(0 points)**
Question 3a: Use of the resource	Student explained how he or she was going to use the resource **(1 point)**	-----	No explanation of using the resource **(0 points)**
Question 3b: Repetitions	Student explained how many times he/she deemed it necessary to use the resource in order to understand the weakness being addressed **(1 point)**	-----	Student did not explain how many times he/she deemed it necessary to use the resource **(0 points)**
Question 3c: Time Management	Student explained when he/she planned to use the resource and how much time would be devoting, accounting for other time-consuming activities such as work, other classes, or family obligations. **(1 point)**	Student explained when he/she planned to use the resource OR how much time would be devoted OR did not account for other time-consuming activities **(0.5 points)**	Student did not explain when he/she planned to use the resource or how much time would be devoted **(0 points)**
Question 4: Comprehension Check	Student has a detailed plan for evaluating how well the resource is helping. Takes into consideration the fact that success will be measured via a test on the information at hand. **(2 points)**	Student has a plan for evaluating how well the resource is helping but does not take into consideration the goal of success on the test **(1 point)**	Student has no evaluation or adjustment plan **(0 points)**

APPENDIX C: MSLQ AND SRSB ANONYMOUS CONSENT FORM

Anonymous Use Consent – Please read this before completing the Motivated Strategies for Learning Questionnaire!

You are invited to participate in a research project entitled *"Impact of an Intervention to Improve Self-Regulation Skills among Students in the Introductory Biology Course at Central Southern Technical College"* designed to analyze the impact of including study skills building activities into the Introductory Biology Curriculum at Central Southern Technical College (CSTC). The study is being conducted by Jessica Lea, a member of the CSTC Biology Faculty. This research is being conducted as part of the dissertation requirements for the University of South Carolina's Curriculum and Instruction, Ed.D. Program.

The MSLQ is comprised of 81 questions and should take approximately 20-30 minutes of your time. The SRSB activities are graded activities that equate to a small percentage of your overall course grade. Your choice to participate or not participate in this study will not impact your grades on graded assignments. Your replies will be anonymous, and your multiple choice answers will be used in terms of averages and not as individual scores. There are no known risks involved with this study. Participation is voluntary and there will be no penalty or disadvantage in terms of grades, pass rates, or due dates if you choose not to participate in this research study or to withdraw. If you choose not to participate, you may either return this blank form or you may discard it. If you do not consent to being a part of this research, answers on assignments linked to this study will not be used as a part of the research statistics. Returning this signed consent to your instructor indicates your consent for use of the answers you supply. If you have any questions about the study you may contact Jessica Lea at (803)778-7836).

Please keep this page for your records.

Anonymous Use Consent

By signing below, you are consenting to participate in a research project entitled *"Impact of an Intervention to Improve Self-Regulation Skills among Students in the Introductory Biology Course at Central Southern Technical College"* designed to analyze the impact of including study skills building activities into the Introductory Biology Curriculum at Central Southern Technical College (CSTC). All answers, grades, and statistics will be completely anonymous and no names will be used in the reporting of this data. Choosing not to participate there will be no penalty or disadvantage in terms of grades, pass rates, or due dates if you choose not to participate in this research study or to withdraw.

By completing this consent form and returning it you are also confirming that you are **18** years of age or older.

Your signature below indicates that you have decided to volunteer as a research participant for this study, and that you have read and understood the information provided above.

You may withdraw from the research at any time by contacting Jessica Lea at (###) ###-#### or via email at leajb@########.edu.

Subject's Name (print): _____

Subject's Signature: _____ Date: _____

APPENDIX D: THE MOTIVATED STRATEGIES FOR LEARNING QUESTIONNAIRE

Motivated Strategies for Learning Questionnaire

Please rate the following items based on your behavior in this class. Your rating should be on a 7-point scale where **1= not at all true of me** to **7=very true of me**.

1. I prefer class work that is challenging so I can learn new things.
2. Compared with other students in this class I expect to do well
3. I am so nervous during a test that I cannot remember facts I have learned
4. It is important for me to learn what is being taught in this class
5. I like what I am learning in this class
6. I'm certain I can understand the ideas taught in this course
7. I think I will be able to use what I learn in this class in other classes
8. I expect to do very well in this class
9. Compared with others in this class, I think I'm a good student
10. I often choose paper topics I will learn something from even if they require more work
11. I am sure I can do an excellent job on the problems and tasks assigned for this class
12. I have an uneasy, upset feeling when I take a test
13. I think I will receive a good grade in this class
14. Even when I do poorly on a test I try to learn from my mistakes
15. I think that what I am learning in this class is useful for me to know
16. My study skills are excellent compared with others in this class
17. I think that what we are learning in this class is interesting
18. Compared with other students in this class I think I know a great deal about the subject
19. I know that I will be able to learn the material for this class
20. I worry a great deal about tests
21. Understanding this subject is important to me
22. When I take a test I think about how poorly I am doing
23. When I study for a test, I try to put together the information from class and from the book
24. When I do homework, I try to remember what the teacher said in class so I can answer the questions correctly
25. I ask myself questions to make sure I know the material I have been studying
26. It is hard for me to decide what the main ideas are in what I read
27. When work is hard I either give up or study only the easy parts
28. When I study I put important ideas into my own words

29. I always try to understand what the teacher is saying even if it doesn't make sense.
30. When I study for a test I try to remember as many facts as I can
31. When studying, I copy my notes over to help me remember material
32. I work on practice exercises and answer end of chapter questions even when I don't have to
33. Even when study materials are dull and uninteresting, I keep working until I finish
34. When I study for a test I practice saying the important facts over and over to myself
35. Before I begin studying I think about the things I will need to do to learn
36. I use what I have learned from old homework assignments and the textbook to do new assignments
37. I often find that I have been reading for class but don't know what it is all about.
38. I find that when the teacher is talking I think of other things and don't really listen to what is being said
39. When I am studying a topic, I try to make everything fit together
40. When I'm reading I stop once in a while and go over what I have read
41. When I read materials for this class, I say the words over and over to myself to help me remember
42. I outline the chapters in my book to help me study
43. I work hard to get a good grade even when I don't like a class
44. When reading I try to connect the things I am reading about with what I already know.

For educational use from:

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