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The Importance of Science Instruction: A Case Study of Exemplary Teaching and Administrative Support

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By

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The importance of science instruction: A case study of exemplary teaching and administrative support

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There were several purposes to this case study using a convergent parallel mixed method design. The first purpose was to explore how one exemplary high school science teacher (EST) and her selected supporting administrator rated the importance of particular elements of science instruction. The second purpose was to describe how an EST explained her practices of fostering success for her students. The third purpose was to identify the administrator's practices that supported the EST as described by both educator participants.

Data for this study were collected through two researcher-developed instruments, interviews, and documents. The EST completed the *Questionnaire of Exemplary Science Teachers* (QEST), and the administrator completed the *Questionnaire for Administrator Perception of Exemplary Science Teachers* (QAPEST). The researcher also conducted an interview with each participant and analyzed documents (i.e., lesson plans, students' course grades, and Biology Subject Area Testing Program results). The EST examined data to provide context to the case study.

Results of the study revealed that both the EST and administrator understood and closely agreed on the importance of science and in the methods of planning and teachingscience. Results also indicated that students taught by the EST were successful in a science program. The EST used a combination of specifying objectives, diagnosing and evaluating student learners in science instruction, planning of science instruction, and delivering of science instruction to assist her students in becoming successful. Results also revealed that the EST and the administrator believed that building strong personal relationships with the students motivated students to want to succeed even more for the EST. Finally, results indicated that unwavering, generative administrative support was helpful in supporting the teacher's exemplary instruction.

DEDICATION

I dedicate this research study to my amazing husband Brian Dace and to my awesome son Brijuan Dace for being a loving, supportive family and believing in my dream. I also dedicate this research study to my deceased mother, Faletha Fripp, for showing me how transient life is; therefore, one must make the most out of life and live it to the fullest.

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CHAPTER I

THE NATURE OF THE PROBLEM

Introduction

Science teaching can be both exciting and challenging. The current advancements in science and technology are almost miraculous regarding their impact on individuals and society. Though some areas of science have expanded beyond measures, the instruction of science in schools has not experienced similar advances. An analysis of the history of science education in America leads to the conclusion that science curriculum innovation is continuously in a state change. To date, there are continuous modifications that have been planned and implemented to meet the current national and global needs (Chiappetta & Koballa, 2010; Jessa, 2011). Compared to the other subjects, changes in the science curriculum occur at a much faster pace due to significant impact created by science and technology advancement. As a result, science teachers must be well-equipped with the necessary knowledge and skills to stay abreast of changes and to be sure that what is outlined in the curriculum is being realized in the classroom.

Science teachers must also be supported in their efforts to deliver exemplary instruction. Therefore, professional development and administrative support should be integral parts of the efforts made to raise the standard of teaching, learning, and student success. According to Hodgkinson (1995), to improve science achievement, educators must rethink instruction and instructional arrangements because there is a connection among student success, resources, and socioeconomic status. There also is a connection among educators' perceptions of the importance of science instruction, exemplary teacher, and administrative support. Educators must perceive science instruction to be important and must be supported by their administrators in order to be exemplary. Understanding these factors was the intent of this study.

Teacher of the Year, Star Teacher, and Exemplary Teacher: These words are heard loudly and clearly in the world of education. Teachers and administrators are all familiar with the awards and achievements that result from the hard work and dedication of educators. The hard work goes beyond the classroom and builds relationships that last a lifetime, leaving a lasting impression on both teachers and students. According to Chiappetta and Koballa (2010), too many students continue to find school science unappealing and fail to see its relevance to their personal lives and to society. "School science is now challenged to address the needs of an increasingly diverse population of students and measures of educational accountability that are most visible in the new state and national standards and the accompanying standardized tests" (Chiappetta & Koballa, p. xi).

To help students be successful in science, educators need to develop an understanding of how to help students and all others see science as a way of thinking and investigating, as an accumulating body of knowledge. A science educator's role is one of helping students see the wonderments of science through their instruction. Students must be taught how to recognize the relationship between science and their daily lives, a healthy environment, and a productive society (Chiappetta & Koballa, 2010). In order for science teachers to implement such practices, they must believe in the importance of science instruction and be supported by their administrators.

Background of the Problem

Science is important in several areas. Everyday human life would not be the same if it were not for science. For example, advances in the biomedical fields have decreased the number of infectious or lethal diseases more so than ever before. Due to advanced research in bacteria and viruses, deadly diseases are now manageable and, in some cases, have been eradicated. Secondly, science has increased the life span of people as we are now able to understand more about aging and the nutrients needed to keep the body healthy. Thirdly, science has greatly influenced industry. For example, to accommodate the demand for quicker and faster technology, nanotubes are being made to make faster microchips a reality (Jessa, 2011). However, researchers suggest that emphasis on science needs to be more of a priority in the United States.

Jessa (2011) stated, "It seems that the importance of science has declined in the past couple of years. However its necessity in growing the economy and finding new solutions to old problems and dilemmas remain the same" (p. 1). Science plays a vital role in our country's ability to compete and surpass other countries. Therefore, monies must be made available for equipment and research in order for great discoveries to be made. Jessa (2011) further explained, "there is a real chance for major nations losing ground in the sciences if they do not make the conscientious effort to invest in research and development" (p. 12). It is the belief of President Obama (Jessa, 2011) that innovation is the key to "winning the future" (p. 12). If America is going to compete and lead the world in the future, innovation and technology is the path that must be followed. Basic labor can gain value one day and lose it the next, but the possibilities and new markets created by science and invention are indefinite (Jessa, 2011).

Nucci (2012) maintained that in his January 2012 State of the Union address, President Barack Obama made references to business leaders being unable to find workers in United States with the appropriate skills. Growing industries in science and technology have twice as many openings as there are qualified workers. President Obama contended that the inability to find qualified workers is inexcusable in a time when millions of Americans were seeking employment.

Following the President's speech, his Council of Advisors on Science and Technology linked those economic challenges to K-12 education. According to Nucci (2012), the Council, along with The Gathering Storm committee, made the following two recommendations:

> Provide 10,000 new mathematics and science teachers each by funding competitively awarded 4-year scholarships for U.S. citizens attending U.S. institutions that offer special programs leading to core degrees in mathematics, science, or engineering, accompanied by a teaching certificate. Upon graduation, participants would be required to teach in a public school for five years. (p. 2)
>
> Strengthen the skills of 250,000 current teachers by such actions as subsidizing the achievement of master's degrees (in science, mathematics, or engineering) and participation in workshops, and create a world-class mathematics and science curriculum available for voluntary adoption by local school districts throughout

> the nation. This recommendation will ensure that teachers across the board will have professional development that strengthens the instructional methods in the classroom. (p. 3)

The main objectives of recent reform studies in the field of science teaching are the preparation of individuals for the rapidly changing and developing era of science and technology and fostering of scientific and technological literacy. These objectives are enforced by schools and are considered valid by the American Association for the Advancement of Science (AAAS). The success of these reform studies depends on teachers' self-confidence in using the innovations promoted by these programs. In other words, it depends on the development of an influential self-efficacy among teachers (Azar, 2010). According to Johnson (2012), in the United States, the National Science Education Standards (NSES) called for an instructional shift in science teaching that included moving away from teacher-centered, less-effective instruction and toward the use of more-effective exploration driven by student interests in the context of the real world (p. 2). Science must be an important component of students' academic path if they are to become vital citizens in society.

Federal mandates, such as the No Child Left Behind (NCLB) Act of 2001, have required increasing levels of accountability to position highly qualified teachers who possess the content knowledge and skills to deliver instruction to all students, in each classroom. According to Williams (2005), the instruction for students entering college has been based on basic skills and driven by test scores; therefore, comprehension and critical thinking have been avoided (Foote, 2007). According to the National Research Council (1999), in order for science teachers to be effective, they must "(a) have a deep foundation of factual knowledge, (b) understand facts and ideas in the context of the conceptual framework, and (c) organize knowledge in ways that facilitate retrieval and application" (p. 16).

All teachers have different techniques that they utilize to teach science to students; however, science teachers today face great challenges when deciding how to deliver science instruction. Agee (2000) stated, "Teachers bring their own funds of knowledge from diverse settings to bear on pedagogy" (p. 7) in all content areas. Therefore, teachers who create effective instructional environments contextualize instruction to appeal to student interests, present new science concepts, use students' prior knowledge and experiences to shape understanding (Johnson, Zhang, & Kahle, 2012). According to Braun, Coley, Jia, and Trapani (2009) students that read science textbooks more frequently, ask to write long answers on tests or assignments, and work with others on projects are associated with higher average scores. Contextualizing instruction is believed to promote transfer of science ideas to other contexts because students learn to relate content ideas to problems and situations that are meaningful in their lives and in the real world. Undoubtedly, traditional, teacher-centered instruction relies heavily on text, lecture, and other structured activities that provide few opportunities for students to feel a connection to what they are learning in science (Johnson et al., 2012).

Previous research has found meaningful ways for teachers to convey scientific instructions to their classes. Manipulation has been used as one way to teach science instruction. According to Schroeder, Scott, Tolson, Huang, and Lee (2007), manipulation strategies require students to become active learners who participate in building their own understanding as students remember content better when they experience it for themselves. Providing frequent opportunities for students to actively interact with abstract scientific concepts is critical to developing their understanding of these concepts in a personally meaningful and memorable way. Researchers have observed that computer-based, virtual simulations can provide experiences that are just as concrete to students as activities involving physical objects, and can, in fact, go beyond what is possible in the physical realm. This is due in part to computer-based activities, which can dynamically link multiple representations together and optimize displays to focus students' attention on the activity's key learning objectives (Schroeder et al., 2007).

The amount of material to be covered within the science curriculum can sometimes cause teachers to feel overwhelmed and rushed, producing a negative result. "Large amounts of curriculum and standards are assigned to each grade level, and teachers often opt to cover more items in less depth, resulting in more teacher-centered instruction and fewer opportunities for inquiry" (Johnson et al., 2012, p. 10). Research-based studies propose that it is better to "teach in depth" rather than "in breadth" and to increase instruction throughout grade spans (Mississippi Department of Education, 2009, p. 2).

Inquiry-based learning is another strategy many teachers are implementing to give scientific instructions in the classroom. Inquiry differs from traditional instruction in that traditional is more often lecture based, teacher directed, and highly structured (Saunders-Stewart, Gyles, & Shore, 2012). Some of the primary goals of inquiry in science are an understanding of scientific methods and mastery of science facts, concepts, and principles. Although traditional approaches may focus on content, inquiry advocates suggest that through a focus on the learning process, students will consequently attain a knowledge base in the subject matter. Saunders-Stewart, et al. (2012) referred to inquiry-based education as a learner-centered form of teaching and learning that allows students to fit and use some of their learning experiences to their own interests and curiosity. Evidence was sought that addressed inquiry in the different ways in which inquiry occurs in classrooms—as process, content, and strategy to capture as wide a range as possible of inquiry outcomes, and not be limited to a single discipline or definition. In process, activities are guided by learners' curiosity and interests. This will help students learn process skills, such as critical thinking, that can be generalized across subject domains. Content is active investigation consisting of critical thinking and reflection that provide opportunities for rich interaction with the material. This causes the students to achieve a deep understanding of the content and become more equipped to apply knowledge. Strategies consist of problem-solving, planning, organization, and self-regulation that empower students with the skills to carry out self-guided and collaborative investigations. Context consists of the learners being able to make meaning from experience. An inquiry environment requires multiple forms of resources, access to data, individual as well as group activities, dialog, and reflection (Saunders-Stewart, et al., 2012).

According to Schroeder et al., (2007), inquiry is a way of providing engaging opportunities for students to experience the nature of science by allowing them the practices of scientists and requiring students to answer scientific research questions by analyzing data. The involvement generated during inquiry encourages deep understanding. The heart of effective inquiry-based learning in science is conducting experiments and analyzing the results. Inquiry-based learning cannot adequately take place without the proper technology. Teachers must invest in using technology in the classroom that will aid students with efficiently covering a multitude of "classic" science experiments involving a number of topics, such as seed germination, density, friction, solubility, simple machines, and many more. Technology provides teachers and students with opportunities to go far beyond what is possible in the classroom or lab, such as investigating human homeostasis, observing radioactive decay, experimenting with natural selection, or using triangulation to determine the epicenter of an earthquake by analyzing the arrival of its primary and secondary waves at multiple recording stations (Schroeder et al., 2007).

The use and incorporation of technology into the classroom enhance the teacher's ability to reach the abstractness of students' minds and to accessthe capability of the students.   Instructional technology is an enhancement for teachers to meet the challenges of providing effective instruction and conducting inquiry in the classroom. This can be achieved through the use of computers, which can be used for visualizations, simulations, and modeling abstract concepts. (Schroeder et al., 2007). Inquiry learning can significantly progress student attainment and comprehension achievement as compared with conventional knowledge (Sauders-Stewart et al., 2012). Previous research concluded that "[i]nquiry may produce improvements not only in specific test scores but also on overall science achievement" (Saunders-Stewart et al., 2012, p. 16). Inquiry strategies are student centered, with students answering scientific questions through investigation. According to previous research, "[T]he problem with the method of inquiry is that not enough teachers use it, not enough understand the power inherent in inquiry and not enough see their job as other than transmitting information" (Johnson et al., 2012, p. 2).

“Since most state assessments focus on recall of content knowledge through de-contextualized facts, teachers are apprehensive to use strategies other than basic recall as primary methods for teaching science to children” (Johnson et al., 2012, p. 3). For some teachers, science is not the original field of choice, and therefore, they are less prepared than those who have greater teaching experience in science. Students whose teachers hold a standard teaching certificate may score higher than those students who have teachers with other or no credentials. According to Johnson et al. (2012), “[O]ne of the fundamental issues in science-education reform today is encouraging science teachers to use more effective instructional strategies including contextualized teaching, inquiry, questioning, and cooperative learning to teach science” (p. 9).

Statement of the Problem

Like many other school districts, the district in this study is confronted with the problem of inadequately trained science teachers attempting to teach students from low socioeconomic backgrounds. As a result, teachers are not able to neither understand nor reach the full potential of their students. Though these teachers use various teaching strategies in their science classrooms, they are in great need of in-service training in order to teach science meaningfully and effectively while filling the gaps of content knowledge and pedagogy in the subject (Subahan, Lilia, Khalijah, & Ruhizan, 2001).

This research needed to be conducted because some science education studies have concluded that the science curriculum is continuously in a state of change (Mississippi Department of Education, 2010, 2012; National Research Council, 1996; National Science Teacher Association, 2000, National Society for the Study of

Education, 1947; No Child Left Behind, 2001; NSTA Standards for Science Teacher Preparation, 2003; Yager, 1982). Continuous modifications have been planned and implemented to meet national and global needs (Mississippi Department of Education 2010, 2012; National Science Education Standards, 1996; National Science Teachers Association, 1992; No Child Left Behind, 2001). These changes occur at a faster rate due to the impact of science and technology advancements. Therefore, it is imperative that research be conducted on an exemplary science teacher (EST) who is able to foster student success in spite of these changes. Research that identifies how ESTs specify objectives, diagnose and evaluate learners, and plan and deliver science instruction is limited. In addition, there is insufficient research on administrative support for exemplary teachers.

Purpose of the Study

The initial purpose of this study was to identify the practices used by an EST to promote achievement for African-American students in biology. However, in responses to the quantitative instrument and qualitative interview, neither the EST nor her chosen administrator provided responses that focused specifically on African-American students. Nevertheless, these students were successful in the EST's course and further research is recommended to explore this phenomenon. This recommendation is discussed further in Chapter V.

The purpose of the study was revised to highlight the alignment of the quantitative and qualitative data. As such, there were several purposes to this case study using a convergent parallel mixed methods design. The first purpose was to examine the attitudes of an exemplary high school science teacher and her selected leading administrator on the importance of science instruction. The second purpose was to determine how an EST fosters success for her students. The third and final purpose was to identify the administrative practices that supported the exemplary high school science teacher as she fostered success for her students.

Research Questions

Because data were collected using quantitative and qualitative methods, there were both quantitative and qualitative research questions used to guide this study.

Quantitative

1. How do an exemplary high school science teacher and her selected supporting administrator rate the importance of particular elements of science instruction?

Qualitative

2. How does an exemplary high school science teacher describe fostering success for her students as she specifies objectives, diagnoses and evaluates learners, plans, and delivers science instruction?
3. How are the administrative practices that support an exemplary high school science teacher described?

Definition of Key Terms

The following definitions of frequently used terms in this research project are given to help clarify their meaning throughout this study:

Administrative Support is when an administrator provides exemplary teacher support by allowing her to facilitate her classroom, share teaching strategies with other teachers, and provides her with professional growth opportunities (Foote, 2007).

Delivering Science Instruction is when a teacher possesses content knowledge and skills to deliver content by engaging students, posing questions, gathering data to form explanations, and conducting investigations--teacher that scores 3 or 4 on the Questionnaire of Exemplary Science Teachers (QEST) Likert-scale in Part D, numbers 1-3 (Williams, 2005).

Diagnosing and Evaluating Learners include standardized assessments at grades 5, 8 and Biology I and in class diagnostics and evaluations to determine starting points and progress monitoring--teacher that scores 3 or 4 on the QEST Likert-scale in Part B, numbers 1-2 (Azar, 2010).

Exemplary Science Instruction is when a teacher possesses content knowledge and skills to deliver content by engaging students, posing questions, gathering data to form explanations, and conducting investigations. A teacher that scores 3 or 4 on the QEST Likert-scale in Part D, numbers 1 – 3 (Williams, 2005).

Exemplary Science Teacher is defined by practices that include respecting students, accepting responsibility for what takes place in his or her classroom and recognizing that learning means empowerment and is the ultimate goal in class (Ladson-Billings, 1994).

High School is a school that includes grades 9-12. It is the last school that a student must attend and complete (graduate from) before entering college (Webster, 2005).

Planning Science Instruction is recognizing the importance of science, the influence of reading, and making monies available for equipment and research--teacher that scores 3 or 4 on the QEST Likert-scale in Part C, numbers 1-2 (Singh, Granville, & Dika, 2002).

Relationships are the dynamics created between the person and the setting (Wheatley, 1992).

Science Teachers Inventory of Needs (STIN) is an 83-item instrument that is organized into seven categories that assess science teachers' perceptions of their professional needs (Zurub & Rubba, 1983).

Specifying Objectives is a specific body of knowledge that is centered on research and best practices offered by education programs--teacher that scores 3 or 4 on the QEST Likert-scale in Part A, numbers 1-6 (Zurub & Rubba, 1983).

Success according to the Langsdale School District grading policy is a student who passes the Biology I course with 60% or higher and with an interval score of proficient or advanced on the state test (SATP Biology-I)

Teacher Self-Efficacy means that what teachers think affects how they behave, and their behavior directly affects student achievement (Bandura, 1997).

Overview of Method

This convergent parallel mixed methods design was conducted using two researcher-developed instruments, interviews, and documents. The sample for this study included one exemplary science teacher and one administrator that the EST chose from the high school located in the Langsdale School District, a pseudonym. The science teacher is a Caucasian, female Biology I teacher, and the administrator is an African-American male. While generalizations cannot be directly made from this example to others, this detailed description of the components of an EST and the case in which she worked with can inform those searching for documented instances of exemplary science teaching practices in specific settings (Creswell, 2003).

The EST completed the QEST, and the administrator completed the *Questionnaire for Administrator Perception of Exemplary Science Teachers* (QAPEST). The researcher also conducted an interview with each participant and analyzed documents to include lesson plans and students' course grades and Biology SATP results. Prior to the data collection for this particular study, two science teachers agreed to assist in the validation of the QEST and the QAPEST. These instruments were created by the researcher using Rubba's (1983), STIN. The STIN was the main reference for this study. The researcher carefully selected items in the STIN to reflect the current literature on the best science teaching practices that secondary science teachers use. The researcher created item development for the original instruments by narrowing of STIN topics to the following steps: (1) reviewing of existing subscales, (2) reviewing and analyzing the practices in the current science teaching literature, (3) adding, editing, and eliminating irrelevant items from the initial pool of items, and (4) pilot testing the instrument with volunteer science teachers. The researcher followed the same steps to create the administrator's instrument. Both instruments will be fully discussed in the methods section of this dissertation.

Limitations and Delimitations

Limitations are defined as weaknesses in a study that are outside of the researcher's control (Simon, 2011). Delimitations are defined as factors that are in the researcher's control that limit the scope and define the boundaries of the researcher's study (Simon, 2011). Due to the nature and design of this study, there were some identified limitations and delimitations.

One limitation that could affect the application of the findings of this study in other settings is the nonrandom selection of the teacher and administrator who participated. This is a limitation because there are only two science teachers who teach Biology I in the conveniently sample selected school and district. The case study participant selected as the science teacher of focus for this study was limited by the qualities of exemplary science teaching defined by current exemplary science teaching literature and practice. Between the two teachers available for selection in this study, only one of the science teachers exhibited the criteria of exemplary science teaching. The limitation of the research paradigm context insists that this particular teacher be the focus of this study. The researcher had no control over the selection of this teacher, rather the teacher's specific characteristics were the limiting factor.

Randomization or other clinical techniques for participant selection is always preferable in empirical research designs when possible. However, in this study the most reliable, valid participant selection process was used since the entire Biology I teaching staff of Langsdale High School was considered to become the research participant of focus. Thereafter, the study participant was limited to the precisely selected participant by her own distinct exemplary science teaching characteristics. As is true when conducting most educational research, randomization was not possible in this study (Fraenkel & Wallen, 2009).

There were delimitations in this study. One delimitation in this study was that the researcher centered the study in only one geographical area using a convenient sampling method. This study was conducted at a high school in a rural community that is racially, socio-economically, and academically different than the other public high school and district in this county. Therefore, the findings could be useful to only similarly situated high school and district cases which are carefully matched by multiple demographic characteristics making them highly similar to the district of focus in this study. According to Fraenkel and Wallen (2009), a researcher cannot generalize beyond the sample that one is studying. This is a true statement for this case study due to the circumstances of the project.

Other delimitations of this study were embedded in the researcher's choice not to use students as part of this case study. No students were directly involved in this study, rather the academic scores associated with students of the EST were reviewed without student names or identifying information. The researcher's decision to use only one standardized test and one Biology I course grade as a measure of exemplary student outcome limits this study. The researcher's decision to use only a single year's worth of the academic scores limits this study. Students' academic performance data were included as only one outcome measure to determine the degree to which the teacher selected was described as exemplary. The act of using this student data is not viewed as delimiting since other data points to determine the teacher's exemplary nature were also used.

The researcher selected the specific science content area of Biology I as the content area of focus for this study. Therefore, study findings will be delimited in their application to only the single content area of science, primarily Biology I. This is a delimiting factor since the researcher was in control of this research design decision. While other subjects were required to be tested by the state, for this study, the main area of interest was in science classrooms, specifically in the area of biology. The results of the study, therefore, may be less useful to instructional settings for disciplines other than science.

Significance of the Study

The significance of this study is that it adds to previous research, addresses gaps on the EST's practices and administrative support of an exemplary teacher, and provides a focus in science instruction specifically for Biology I. More studies and professional development are needed to help science teachers stay abreast of the fast-changing science curriculum, and more studies are needed to help provide teachers with effective teaching strategies for all students.

This study also is significant because of a finding related to African-American students. The EST identified in this case study fostered success for her African-American students. While no specific racial or ethnic group of students was the focus of the study, this surprising finding provides significance and promise for future research. More discussion on this area of significance is included in Chapters IV and V.

Organization of the Study

In Chapter II, the researcher provides a review of the literature that pertains to the areas of science instruction, characteristics of ESTs, and relationships between teachers and students. In Chapter III, the researcher explains the methodology of this study, outlining how data were obtained and analyzed. In Chapter IV the results of the research are presented. In Chapter V, a summary of the study, conclusion, and recommendations are offered.

CHAPTER II

A REVIEW OF LITERATURE

Introduction

This study was designed to examine the attitudes of one exemplary high school science teacher and her selected leading administrator on the importance of science instruction, to determine how an EST fostered success for her students, and to identify the administrative practices that supported the exemplary high school science teacher. The study was conducted at Langsdale's High School, a pseudonym, and data were collected through the using the QEST and the administrator completed the QAPEST – which were both created by the researcher using the STIN (Zurub & Rubba, 1983) as a model – interviews and documents, to include lesson plans and students' course grades and Biology SATP results.

The review of literature focuses on science teachers' and administrators' ratings on the importance of science instruction; the practices of an EST in four areas of science instruction: (a) specifying objectives for science instruction, (b) diagnosing and evaluating science instruction, (c) planning science instruction, and (d) delivering science instruction and the administrative practices that support science teachers' instruction.

According to Adeyemo (2012), Chen and Howard (2010), George (2000), and Papanastasiou (2000), science teachers' and administrators' ratings on the importance of science instruction represent their attitudes toward science, which consist of the fundamental components of belief, feeling, and action. Eagly and Chaiken (1998) defined attitude as a psychological tendency expressed by a particular entity as supportive or not supportive. Belief relates to the thinking that one has toward science that provides the learners with scientific information and findings. However, the feelings toward belief are the key component of how educators perceive the importance of science. Another important aspect that is influential in the ratings of science importance is its hierarchical characteristics and framework of an organized and integrated mental condition (Kristiani, Susilo, & Aloysisu, 2015).

The cognitive component in an administrator's or teacher's attitude gives them the power to be able to think systematically as a scientist does, which reflects the mind-set that is in accordance with the science principle or science ethics (Kristiani et al., 2015; Rao, 1996). This may also influence the way that students feel toward the importance of science. However, with the use of an appropriate biology learning strategy, students' attitude toward science can be trained. There are several studies relating to the correlation between attitude toward science and academic achievement (Altun & Cakan, 2006; Kusutanto, Fui, & Lan, 2012; Li & Armstrong, 2009; Mubeen, Saeed, & Arif, 2013).

Exemplary Teaching

Singer (1996) suggested that exemplary educators are not simply "teachers who define success as keeping students in their seats, building administrators who are satisfied when there are no blow-ups that require police intervention, and district officials who function as bookkeepers tracking scores on standardized exams" (p. 4). It is easy for educators to identify or define areas of improvement in the field of education than it is to seek what contributes or constitutes successful teaching (Singer, 1996).

Ladson-Billings (1994) noted that exemplary teachers are defined by successful teaching practices. The teacher respects the humanity of students and accepts responsibility for what takes place in his or her classroom. The teacher actively involves students in the creation of classroom communities and uses a constructivist model for classroom instruction that builds on what students already know. The classroom communities are used to establish behavior and learning norms. The teacher sides with students against a debilitating social and educational status quo. The teacher recognizes that learning means empowerment and is the ultimate goal in the classroom (Singer, 1994).

There are two distinct characteristics of exemplary teachers. According to Singer (1996), successful teachers teach on any level. Regardless of the group of students they may encounter, there are two attributes exemplary teachers demonstrate well. First, exemplary teachers help students expand their vision of what is possible in their lives. Secondly, exemplary teachers help students achieve, whether what they want to do is assimilate or not because students succeed in despite the many challenges they may face. They do not allow the injustices of the system or challenges to interfere with student learning. They change it. Successful teachers teach people. They possess more than technical proficiencies or knowledge about subject and pedagogy.

Specifying Objectives for Science Instruction

Spencer (2001) stated that teaching is a profession. Strom (1991) maintained that in the profession of teaching, there must be a specific body of knowledge “that is applied with wisdom and ethical concern” (p. 2). Strom further suggested that determining the knowledge base that teachers should attain in order to facilitate classroom instruction is a social process that is created by the community where the teacher instructs his or her students. Many researchers turn to documented research to justify what constitutes an essential knowledge base for teaching. Buehl and Moore (2009) declared that research is a justifiable construct to use when determining instructional practices that work best in the classroom. Readence, Bean, and Baldwin (2004) stated that the notion of what an acceptable knowledge base actually is typically centers on the research and best practices that are offered by teacher-education programs. Moore and Hopkins (1992), for example, declared that “[t]eachers, like other professionals, need a sound body of knowledge to draw from when deciding how to proceed in complex situations” (para. 1). This knowledge is provided for most teachers through the institutions of higher education where they earned their teaching credentials.

Chiappetta and Koballa (2010) stated that specifying objectives that are appropriate for today’s students calls for an examination of national and state standards documents and locally developed course frameworks that are key to standards. The national and state standards give a vision of a scientifically literate adult citizenry by providing what students should know and be able to do at different grade levels. Though state standards are a reflection of national standards, contextual changes within the standards are based on regional and cultural differences (National Science Teachers

Association, 2012). A well-developed framework provides an overview of the science course by outlining the units that make up the course and the topics or concepts addressed in each unit or curriculum map to show relationships. Secondly, a framework provides a description of each unit and the multiple standards that the unit is intended to meet. This may also be done by using the backward design approach (Wiggins & McTighe, 2005).

Chiappetta and Koballa (2010) highlighted eight elements likely to be found in state and locally developed science course frameworks that must be understood by science teachers. These elements are course description, course map, learning outcomes, unit overview, essential or guiding questions, summative assessment task, knowledge, skills and dispositions, and learning experiences. Course description, "tells what the course is about and how the course is related to other science courses" (p. 37). Course map is the outline of the units or concepts and the relationship among them. Learning outcomes specifies students' understanding as a result of instruction. Unit overview gives a general description of the unit focus with more specific outcomes. Essential or guiding questions focus on students' learning experiences. Summative assessment task displays what counts as evidence of student learning. Knowledge, skills, and dispositions "describes the building blocks of understanding and often the target of learning experiences" (p. 37). Learning experiences display the lessons in which students engaged.

Diagnosing and Evaluating Learners

The science achievement of students and the science literacy of the general population in the United States are mediocre (Braun et al., 2009). Such weakness does not prefigure well for our nation's aptitude to contend with the growing science and engineering endowment that is up and coming among the many nations with which we will be both opposing or collaborating with in the future (Braun et al., 2009). According to Braun et al. (2009), "The science achievement of United States students has been flat for a decade; in fact, in a recent international assessment, U.S. students ranked lower, on average, than their peers in 16 of 30 developed nations" (p. 3).

According to Chiappetta and Koballa (2010), determining the extent to which students achieve the learning goals specified in standards documents and frameworks is done through assessment. Evidence of learning within the domain of science for students goes beyond rote memory of memorizing and regurgitating textual information. Student engagement should be assessed by probing for understanding, reasoning, and the utilization of knowledge (National Research Council, 1996). Evidence of learning is centered on students being able to use science knowledge and related skills to solve problems, to answer how and why questions, to answer and recognize what they do not know, to provide convincing explanations, and to include personal dispositions in regard to attitudes, beliefs, and values that guide science understandings. Assessments are not isolated events that occur at the end of instruction, but as an important component of planning and teaching.

Chiappetta and Koballa (2010) revealed that assessment for science teaching and learning should consist of four components: the learning goals, beginning-of-instruction assessment, during-instruction assessment, and end-of-instruction assessment. There is no one component that is more or less important than the other. Planning instruction with the assessment in mind benefits teaching success and student learning. Learning goals may come from national standards, state, or locally developed frameworks. They are connected to assessment by indicating what students should know or be able to do or what dispositions they should hold at the end of instruction. Beginning-of-instruction assessment plays a significant role in science learning. What students already know and can do, as well as how they feel about science is gathered during this assessment. A diagnostic test, rather informal through an engaged activity or formal by way of a pretest, must be used to reveal students' understandings in order to better meet group or individual needs through instruction. Abell and Volkmann (2006) maintained that assessment during-instruction assessment should be seamlessness, meaning that instruction and assessment should flow naturally into each other from either direction. The information may be gathered from asking students questions, jotting down key concepts from the lesson, or drawing a picture to show their thinking. This is formative because the purpose is not to generate grades but to provide the teacher with information that will enable her to make adjustments to the instruction that reflect progress and needs of the students. Extensive research has indicated that formative assessment can have a significant impact on student achievement (Black, Harrison, Lee, Marshall, & Wiliam, 2003; Black & Wiliam, 1998). However, there is also an abundance of evidence that the everyday practice of formative assessment has its share of setbacks (Black & Wiliam, 1998; Minstrell & van Zee, 2003; Popham, 2011; Wiliam, Lee, Harrison, & Black, 2004. Poor practices in formative assessment are largely due to teachers' poor knowledge of effective formative assessment (Popham, 2008). Formative assessment lets the students know that the teacher values them as individuals and wants them to experience success.

Marzano and Kendall (2007) stated that assessment of science learning involves the integration of multiple parts that must serve multiple purposes. Often a single assessment can do just that. According to Chiappetta and Koballa (2010), end-of-instruction assessment is summative because it is given at the conclusion of the instruction in the form of a grade. Also, end-of-the-year assessments provide students with the chance to demonstrate their learning as described in the *National Science Education Standards* (1996) by allowing students to show how scientific knowledge can be utilized and information can be reorganized to generate new understandings. Demonstration of student learning can be done through traditional tests as well as other alternative means such as performance tasks, portfolios, presentations, and long-term projects known as balanced assessment (Balanced Assessment Group, 1998).

Other aspects to consider when diagnosing and evaluating learners are students' science-related dispositions on their beliefs, attitudes, and values because these factors impact student's engagement and science learning (Koballa & Glynn, 2007). These students are likely to be lifelong science learners and decision makers (Koballa, Kemp, & Evans, 1997). Information regarding science-related dispositions may be assessed using self-report scales such as Likert scales, students providing open-ended responses to questions using questionnaires or interviews, and teacher observations of students as they work using tally or frequency rating. The provided science-related dispositions can lead to the following three results: improved science instruction, enhanced student learning, and lifelong learning adults who value science and use their understandings of science in their daily lives (Chiappetta & Koballa, 2010).

The last aspect of diagnosing and evaluating learners is grading and reporting grades. Grades are indicators of student learning and "should be based on solid, high-quality evidence about student achievement" (Brookhart, 2004, p. 11). However, all work should not be graded. Though the aspect of student dispositions is important in science instruction, it should not be considered in grading. Meaningful and defensible grades come from assessments that match the course's curricular aims in regard of content, level of thinking, and mode of response rather in the form of a test or an alternative format (Brookhart, 2004).

Planning Science Instruction

Planning provides a "game plan" (Chiappetta & Koballa, 2010, p. 30) of what to teach and how to teach. It is one of the most important elements of teaching. All teachers plan, though some plans are more carefully and thoroughly conceived than others. Teachers who plan well are more likely to be more effective in helping students learn, better at specifying learning outcomes that most students can achieve, more prepared to manage a learning environment where students are expected to be more responsible for their own learning, and more equipped to teach for student understanding rather than rote memorization. However, the most critical element of planning is actually taking the time to plan. There are just as many in-school tasks (meetings and accommodations) as there are after-school tasks (extra-curricular activities) that hinder or interfere with planning. Regardless of the challenges, teachers must be prepared when the bell rings to start class (Chiappetta & Koballa, 2010).

"Frameworks have not been developed to tell teachers how to teach, but to provide a structure for planning instruction to meet standards" (Chiappetta & Koballa, 2010, p. 36). A teacher must also consider science literacy maps as an instructional planning resource because they are based on strand maps that show relationships among concepts and how concepts build upon one another through grade levels (Project 2061, 2001; 2007). When planning, the teacher should consider whom they are planning to teach, what they are planning to teach, how they are planning to teach science, how are they planning to manage the science learning environment, and how they are planning to assess student learning (Chiappetta & Koballa, 2010).

Who are you planning to teach? Students are more important than science in the classroom because without student engagement and cooperation, there can be no science teaching and learning. The teacher must constantly think of and consider all aspects due to the diversity that characterizes today's U.S. school population. The diversity and student attributes must be addressed in planning, teaching, management, and assessment. A teacher must think ahead and predict how students will respond to their instruction and the realities of the classroom in the areas of language skills, classroom behavior, and physical and learning challenges (Chiappetta & Koballa, 2010).

What are you planning to teach? This question is simple: As a result of your teaching, what should students know and be able to do? The teacher must be knowledgeable of what students are being asked to do. Teachers must come to view teaching differently from the way they experienced (Lederman & Gess-Newsome, 1999). Teachers must develop pedagogical content knowledge and apply it in their teaching. The pedagogical content knowledge fuses the what and how of instruction that facilitate learning (Shulman, 1986).

Effective teaching causes for effective planning which is a complex set of actions that is based on thoughtful planning and sound decision making. Therefore, when planning Chiappetta & Koballa (2010) consider three important factors. First, employ many teaching skills such as initiating instruction, giving directions, asking questions, giving feedback, and bringing closure to instruction. Second, Use a variety of instructional strategies such as demonstrating, discussing, lecturing, reading, role-playing, working in the laboratory or field, and writing. Whenever possible, use two or more instructional strategies during the period because it is more effective (Rosenshine, 2002). Third, incorporate techniques to enhance learning such as identifying similarities and differences, using graphic organizers, note-taking, practicing, and reviewing.

How are you planning to manage the science learning environment? When planning, three aspects of classroom management that should be considered are creating a positive learning environment, guiding student learning, and addressing student misbehavior. An effective teacher knows all students by name, calls on them to answer questions and take part in the lesson, and has well-communicated, high expectations for the students (Chiappetta & Koballa, 2010).

How are you planning to assess student learning? Often tests are thought to come at the end of a lesson, but assessment should be given frequently during the instruction with more testing. Assessments that are effective are seamless and balanced (Abell & Volkmann, 2006). Chiappetta and Koballa (2010) stated that the focus of assessment should be on students being able to demonstrate that they are learning and apply their understandings in real-world contexts. Therefore, tests and quizzes alone are not the best means for assessing student learning and assessments are not the sole experience of a lesson.

Delivering Science Instruction

In regard to delivering instruction, teaching science as inquiry using a variety of skills, methods, and techniques is the philosophical goal of the National Research Council (1996) and National Science Teachers Association/National Council for Accrediation of Teacher Education (NCATE) Standards for Science Teacher Preparation (2003). The attributes of the teacher are vital to the classroom success when teaching or delivering science instruction. Research strongly supports the concept that a more effective approach to teaching and learning science is to use students' prior knowledge and experiences and allow the students to support or revise their theories by collecting, analyzing and interpreting data, and asking questions (Polman & Pea, 2001). Teaching skills are essential and must be developed in order for a teacher to conduct science instruction effectively. The following teaching skills or behaviors that promote student engagement during instruction are introduction, directions, questions, teaching aids, management, closure, and assessment. The introduction prepares and focuses students' attention on what will be taught. Directions are the communication key for expectations and guidelines. Questions are ways of involving students by causing them to think and respond. Teaching aids are used to facilitate the idea or information and promote student learning such as white-boards, chalkboards, and overheads. Management is what defines all the skills that the teacher displays to maintain productive learning. Closure brings the lesson to an end and help students to review and reinforce what has been presented. Assessment measures and evaluates the students' learning during and at the end of the lesson (Chiappetta & Koballa, 2010).

The delivery techniques or instructional strategies are seen as the general teaching plan for achieving a given set of learning outcomes. Lessons may take on many forms through the teacher's delivery technique. Some may be solely for informational purposes while others may be in the form of firsthand laboratory experience. In the science classroom, there are numerous sections of instruction and various ways to approach the delivery of content. Science teachers are required to be dexterous in such areas as engaging students in inquiry through describing objects and events, posing questions, gathering data to construct explanations, conducting investigations, and considering alternative explanations (Johnson et al., 2012). Several other delivery techniques or instructional strategies that teachers may use are lecture, discussion, demonstration, laboratory work, reading, group work, simulations and games, computers and internet, and recitation (Chiappetta & Koballa, 2010). Lecture is the presentation of information, which is usually used to instruct a large group of students, should be interesting and informative; should advance the understanding of the topic; and should be planned based on the attention span, background knowledge, and interests of the students. Discussion is used to give students a chance to express their views and clarify their ideas by way of whole group, small groups, or pairs. The purpose must be made clear and students must listen carefully. Demonstration focuses on key aspects of a concept and is often of high interest to students. Laboratory work provides students with firsthand experience. It should be used frequently to promote interest and develop comprehension of abstract concepts. Reading allows many aspects of science to be formed from ideas to grasping meanings through printed words rather in whole groups, small groups, or independently. Group work is used to engage students and encourage students to work together, share ideas, and work together cooperatively for a common product. Simulations and games are used to illustrate events and processes that occur in the real world by helping students to visualize objects and events that cannot be seen in the class, a laboratory, or nearby place. Computers and internet provide endless means to the students rather through word processing or graphics programs to organize ideas and findings or to make real-world connections to scientists. Recitation involves students responding to the teacher usually at the end of the lesson to answer questions that pertain directly to the learning outcomes (Chiappetta & Koballa, 2010). Using two or more of the delivery techniques enhances a teacher's lesson and enhances student engagement (Rosenshire, 2002).

Students who understand the conceptual knowledge they are expected to learn will perform better on district, state, and national standardized tests (Chiappetta & Koballa, 2010). When delivering science instruction, teachers should include reinforcement techniques such as note taking, writing, identifying similarities and differences, concept mapping, practice, and feedback. The advancement in research has helped educators understand how to help students develop knowledge structures that promote understanding and retention of subject matter (Rosenshine, 2002).

Theoretical Framework

The theoretical framework of this study revolved around the work of Rost (1991), author of *Leadership for the Twenty-first Century*. In the study Rost stated that leadership is an influence relationship that exists among leaders and collaborators who intend real changes that reflect the purposes mutually held by both the leader and collaborators. Rost claimed that leadership is not what leaders do but what leaders and collaborators do together. His belief of leadership was known as the postindustrial paradigm of leadership. This is different from the 20th Century definition that classifies leadership as good management under the industrial paradigm of leadership where great men and women with certain preferred traits influence followers to do what the leader wishes in order to achieve group or organizational goals that reflect excellence seen as some kind of higher-level effectiveness (Rost, 1995).

According to Rost (1991) leadership consists of four essential elements that must be present if any relationship is to be considered as leadership. First, the relationship is based on influence that is multidirectional and non-coercive. The influence uses persuasion to have an impact on other people but is not limited to just rational discourse. Second, leaders and collaborators are the actors in the relationship. Leaders and collaborators are all doing leadership; therefore, there is no such thing as followership. However, all leadership relationships do not look the same nor are the same. Though there may be many stakeholders involved, the influence patterns from those involved are inherently unequal. Third, leaders and collaborators intend real changes that are purposeful. Changes are not produced in this leadership but intended and then acted upon. The intention is seen as the present while the changes are the future. What is meant by real is that the changes are substantive and transforming. Fourth, the changes the leaders and collaborators intend reflect their mutual purposes representing what both want without being forged into a coercive and influential relationship.

Postindustrial leadership theory builds on influence relationship where leaders and collaborators influence one another about real changes that represent their mutual purposes. Collaborators form relationships with leaders of their own choosing and not those who have authority over them. A true representation of postindustrial leadership involves leaders and collaborators interacting at all stages. The role of the leader and collaborator may change; therefore, when there are several leadership relationships in one organization, this must be understood. This oftentimes causes postindustrial leadership to be confused with management. Rost and Smith (1992) said that both management and leadership are needed if in an organization is to be successful, but it is equally important to know which is which and to keep them separate. There are four contrasting descriptors displayed in Table 1 that separate leadership from management.

Table 1

Contrasting Descriptors for Leadership and Management

Leadership	**Management**
Influence relationship	Authority relationship
Implemented by leaders and followers	Implemented by managers and subordinates
Involves leaders and followers intending real changes in organization	Involves coordinating people and resources to produce or sell goods/services in an organization
Intended changes reflect mutual purposes of leaders and collaborators	Requires coordinated activities to produce and sell the goods/services that reflect the organization's purpose

Rost and Smith (1992) believed that in order for postindustrial leadership to be effective, a leader must show one's self as credible. All five components of credibility must exist or the credibility will diminish, though they are not equally weighted. The five Cs of credibility needed in a leader are character which includes honesty, trust, and integrity; care which the leader is clearly concerned with the welfare of others; courage that consists of the willingness to change and stand up for one's beliefs; composure that is seen as grace under pressure and appropriate display of emotion; and competence as it relates to technical and interpersonal. "The degree to which leaders and followers are seen as credible is the degree to which others in the organization allow themselves to be influenced" (Rost & Smith, 1992, p. 199).

CHAPTER III

DESIGN AND METHOD

Introduction

The purpose of this study was to examine the attitudes of an exemplary high school science teacher and her selected administrator on the importance of science instruction, to determine how an EST fostered success for her students through specifying objectives, diagnosing and evaluating learners for science, planning of science instruction and delivering of science instruction and to identify the administrative practices that supported the EST. This chapter explains the methodology used in this study and is divided into the following sections: research questions, research design, research setting, participant selection, procedures and ethics, data collection, and data analysis. The methodology used for this study was a convergent parallel mixed methods design. The study consisted of the collection of quantitative and qualitative data to include surveys, interviews, lesson plans, and records of academic performance at school, distgrict, and state levels.

Research Questions

The research questions used to guide the data collection are listed below.

Quantitative

1. How do an exemplary high school science teacher and her selected supporting administrator rate the importance of particular elements of science instruction?

Qualitative

2. How does an exemplary high school science teacher describe fostering success for her students as she specifies objectives, diagnoses and evaluates learners, plans, and delivers science instruction?
3. How are the administrative practices that support an exemplary high school science teacher described?

Research Design

According to Creswell (2003), there are three approaches that result from the interconnection of a research design. These three approaches are qualitative, quantitative, and mixed methods. There are several differences that exist among these approaches.

According to Gay and Airasian (2003), qualitative research does not suggest only one way to arrive at an answer yet relies on many "truths". Gay and Airasian (2003) further explained that "qualitative methods involve collecting and analyzing primarily non-numerical data" (p. 20). Bogdan and Biklen (2007) noted there are five characteristics of qualitative research -- naturalistic, descriptive, process oriented, inductive, and sense of meaning. Because human behavior is influenced by context, qualitative researchers conduct data within the natural setting (Bogdan & Biklen, 2007; Gay & Airasian, 2003). Therefore, "it is equally important for qualitative researchers to spend time in the natural setting of the phenomena so they will better understand the participants and the phenomena as it naturally occurs" (Bogdan & Biklen, 2007, p. 5).

The fact that qualitative research is descriptive in nature further allowed the researcher the opportunity to analyze the data as closely as possible to the form in which they were recorded or transcribed. The process orientation of qualitative research allows for focusing on or emphasizing the actual research process that was used. Qualitative research is also thought to be inductive in nature. This means that qualitative researchers do not spend their time searching for data or evidence to prove or disprove ideas/hypotheses that they may have before the start of the study. Instead, all abstractions are built as the participants that have been gathered or studied are grouped together. Lastly, the sense of meaning is derived from how people make sense of their lives.

Gay and Airasian (2003) referred to quantitative research as approaches that describe current conditions, investigate relationships, and study cause-effect phenomena by using "survey or descriptive research to collect numerical data to answer questions about the current status of the participants of the study" (p. 20). The data are usually collected by way of self-administered instruments or telephone polls. The information gathered during quantitative research is descriptive and pertains to the preferences, attitudes, practices, concerns, trends, or interests of some group (Creswell, 2003; Gay & Airasian, 2003).

Creswell (2010) defined mixed methods research as a combination of open-ended qualitative research without predetermined responses and data with closed-ended quantitative research such as questionnaires. Mixed methods came to existence from the idea that all methods had bias and weaknesses, and the collection of both quantitative and qualitative data neutralized the weaknesses of each form of data. The following are the four major types of mixed methods designs: triangulation design, embedded design, explanatory design, and exploratory design (Stake, 2006).

Regardless of which approach is used, the researcher must have a framework for designing his or her research that will bring together claims being made about what constitutes knowledge, a strategy of inquiry, and specific methods. This study was aimed at gathering ratings of science instruction and descriptions of fostering success and administrative support. Therefore, the research design employed had to address the collection of quantitative and qualitative data, suggesting a mixed methods design was most appropriate. After reviewing several mixed methods designs, the convergent parallel mixed methods design was selected.

Convergent Parallel Mixed Methods Design

The convergent parallel mixed methods design is a form of mixed methods design that allows the researcher to converge or merge qualitative and quantitative data in order to provide a comprehensive analysis of the research problem (Creswell, 2014; Stakes, 2006). The researcher typically collects both forms of data around the same time and integrates the information in the analysis or interpretation of the overall results. Both sets of data provide different types of information but yield results that should be the same. Any contradictions or incongruent findings are explained or further probed in this design. (Creswell, 2014; Stakes, 2006).

Using Case Study Inquiry

The study also was conducted within a bounded system as a case study. A number of scholars have defined the specifics of a case study. Merriam (1998) defined a case study as:

> an intensive, holistic description and analysis of a bounded phenomenon such as a program, an institution, a person, a process, or a social unit. A case study can also be described in terms of its overall intent, whether it be to describe, to interpret, or to evaluate some phenomenon or to build theory. (p. xiii)

Gay and Airasian (2003) explained that case studies "focus on the characteristics of a single person or phenomenon, seeking to understand a single person or entity" (p. 164). In the case study, the researcher explores in depth a program, an event, an activity, a process, or one or more individuals that are bounded by time and activity. The researchers collect detailed information using a variety of data collection procedures over a sustained period of time (Stake, 1995). Bing (2013) defined a case study as a "study of situation that analyzes a particular case or situation used as a basis for drawing conclusions in similar situations. A case study is important in that it allows the researcher to study the phenomenon from the inside and outside (Gall et al., 1996).

According to Merriam (1998), a case study may be further researched by its special features, "known as particularistic (focuses on a particular situation), descriptive (end product is thick, rich description of the situation), and heuristic (illuminates the reader's understanding of the situation)" (pp. 29–30). This study was particularistic in that it focused on a particular program, the science program in a particular school district in Biology I, and the success achieved by the EST with administrative support to ensure student success. It was descriptive in that the end product offers an in-depth description through the voice of the EST and the administrator. It was heuristic as it shares with the reader the skills this teacher used in identifying the components that help students to be successful in a science program.

Merriam (2008) stated that in contrast to other forms of research, a “case study does not claim any particular methods for data collection or data analysis. Any and all methods of gathering data, from testing to interviewing, can be used in a case study, although certain techniques are used more than others” (p. 28). Therefore, a case study design was chosen due to researchers’ interest in insight, discovery, and interpretation instead of hypothesis testing (pp. 28–29). For this study, the case study method was of vital importance in observing the practices and collecting opinions of the teacher and administrator who spent their workdays applying the knowledge they obtained through pre-service and in-service instruction. The case study method allowed the researcher to focus primarily on the attitudes of one EST and her selected administrator. The case study design allowed for the use of multiple data sources and focused intently on a smaller sample.

Case Setting and Context

The case study took place in the only high school for the Langsdale School District. The school and district setting is unique in that it is considered the lower income, lower academic functioning, and highest African-American student population in the county. The fact that the EST is situated in the high school commonly referred to as “the

African-American or low income" school is of particular note for this case study. The district has been named Langsdale to protect the identity of any real person, place, entity, or region of the state of Mississippi. The school district has nearly 300 employees and serves 2,000 students in five schools. This profile is similar to approximately 47 school districts in the state of Mississippi. During the school year studied, the district received an accountability status of "C" designated from the Mississippi Department of Education while each individual schools received the following designation: lower elementary – N/A because it does not receive status due to testing starting in third grade, upper elementary - D, junior high - C, high school – B on the Mississippi school district performance rating scale. This performance rating is similar to approximately 47 school districts in the state of Mississippi. The district had a racial demographic that consisted of 60.34% African-American, 38.61% Caucasian, and 1% other races. However, the high school racial demographics consisted of 65.45% African-American and 34.55% Caucasian. This racial demographic is consistent with several school districts in the state of Mississippi. Eighty-two percent (82%) of the district's students received free and reduced lunch, while seventy-six percent of the high school students receive free and reduced lunch. This free and reduced lunch count is consistent with several school districts in the state of Mississippi. Table 2 displays both the Langsdale District and High School demographic data.

Table 2

Langsdale District and High School Demographic Data

Demographics	District	High School
Number of employees	300	64
Cumulative enrollment	2000	537
Accountability status	C	B
Student racial demographics	African-American – 60%	65%
	Caucasian – 39%	35%
Free and reduced lunch	82%	76%

The school district is divided into five voting districts across rural and small town areas. The county in which the school district is located consists of two separate school districts. However, the school district selected for this study consists of five schools, including two elementary schools (lower elementary, Grades K–2; upper elementary, Grades 3–5) that fed into the same junior high school (Grades 6–8) and then high school (Grades 9–12). Langsdale High School has a total of 64 teachers and five of them are science teachers, with two of the teachers being Biology I science teachers. This district was chosen because Langsdale is the larger of the two high schools in Langs County. Langs County and Langsdale High School are similar to many other rural counties in the state of Mississippi. With further research, likely, many cases in the rural U.S. are similar to this high school and this county. Therefore, Langsdale was chosen as a common case of science teacher behaviors across the four categories of specifying of science objectives, diagnosing and evaluating learners for science, planning of science instruction, and delivering of science instruction. Also, electing to study one EST, the EST chosen administrator and the EST current science program provided an opportunity for stronger validity.

Participants

According to Gay & Airasian (2003), purposive sampling, also known as judgment sampling, is “the process of selecting a sample that is believed to be representative of a given population” (p. 590). Most sampling in qualitative research is purposive. This type of nonrandom sampling allows the researcher to use experience and prior knowledge to identify criteria for selecting the sample (p. 115). In general, several purposeful sampling techniques were used for the selection of the district and school, and a total population sampling was used for the existing data selection for this study. The school district, school, teacher participant, and administrator for this case study were selected through purposive sampling. All of the participants were selected through a process of validity as demonstrated in the previous case setting and context section in alignment with those suggested for strong qualitative sampling practices.

The Exemplary Teacher. The EST chosen for this study was selected using most of Ladson-Billings (1994) participant selection criteria. Ladson-Billings (1994) used a process to select eight exemplary teachers from a larger group of over 200 in the community where she conducted her case study. In the present research, a similar set of criteria to that noted in Ladson-Billings’ teacher participants was also noted in the teacher selected at Langsdale. The selection criteria common between and among the Langsdale teacher and the eight teachers identified for study in Ladson-Billings research were similar though not exact. The Langsdale EST met the following criteria, making her as closely matched a participant as possible to the teachers selected by Ladson-Billings:

- Recommendaed by parents, principals, and colleagues
- Noted as exemplary in local media (eg. outlets like newspapers, television news report, and/or district, local, or state newsletters)
- Received awards for exemplary teaching
- Requested to provide the Biology I course to students by parents and students
- Willing to include parents as active partners in education without being patronizing and condescending
- Demands academic excellence including intellectual rigor and challenge
- Disciplines students without demeaning or abusing students in any way
- Insights enthusiasm among the students in her class

The Langsdale case did not allow for a large selection pool from which to choose the exemplary teacher, and this is a point of difference from Ladson-Billings process. Additionally, one pertinent criteria held in high esteem in this study but not in Ladson-Billings study was the criteria of good performance on standardized tests and end-of course grades earned by the EST's students.

Of particular note from the work of Ladson-Billings is the ability of students to identify positively with their own culture. In Ladson-Billings' teacher selection she notes that parents excluded certain teachers from an exemplary category due to the fact that the focus of these excluded teachers was too singularly on academic success with standardized tests, class grades, graduation, and college enrollment. In the Langsdale community no mention of the selected exemplary science teacher over emphasizing the academic success with standardized tests, class grades, graduation, and college enrollment was noted. The researcher did use course grades and standardized test scores as measures of this teacher's success. This research design choice was purposeful due to the fact that the Langsdale EST had a record of remarkable student performance on these academic indicators. The researcher initially thought academic success of her students to be an important criteria which demonstrated the exemplary nature of the selected science teacher. Any detrimental effects to students like depression, self-blame, loss of assertiveness, and high incidence of conformity from such a teacher's singular academic focus did not surface as an issue of impact for participant selection at Langsdale. Absence of this phenomena will be referenced later in this study.

At the time the study was conducted, the EST had 12 years of teaching experience with seven of those years in eighth grade science and the previous five years in high school Biology I science. She had taught grades 9 – 12 in the Langsdale School District for five years. She was the selected teacher for this instructional assignment because she was a qualified, licensed teacher according to the criteria of the Mississippi Department of Education (2015). In addition, the district administrators and school colleagues determined her to be a highly successful Biology I teacher by voting her as Teacher of the Year for the school and district. The EST possessed an in-depth of knowledge about her subject and students. The students and parents voiced and supported her as being an exemplary teacher due to her relationship building with both parents and students through attending her students' community events, ball games, student clubs, and church events. The EST attendance at the local events developed a sense of ownership among the students that contributed to each other's learning by creating a community of learners. The EST is female and Caucasian. There were no male teachers or other races serving in this position at the school at the time of this study.

The Administrator At the time of the study, the chosen administrator had 17 years of educational experience with seven of those years as a math teacher and coach. At the time data were collected, the administrator had served as a school administrator for the previous 10 years. The chosen administrator is an African-American male. Table 3 displays the educational background of the teacher and administrator.

Table 3

Participants Educational Background

	Teacher	**Administrator**
Education	Bachelor of Science	Bachelor of Science Master of Science Educational Specialist
Subjects Taught	Biology I 8th Grade Science and Math AP Biology Robots Intro to Biology	Geometry Algebra II Calculus Advanced Algebra Trigonometry
Experience	12 years (5 high school, 7 middle school)	17 years (7 teacher, 10 administrator)
Current Position	Classroom Teacher (AP Biology, Biology II)	Principal
Awards and Achievements	National Board Certified, Teacher of the Year (2x) District Testing Incentive Recipient	Administrator of the Year Most Dedicated and Supportive of Instructional Program Principal's Award Recipient
Race or Ethnicity	White	African-American
Gender	Female	Male

Role of the Researcher

While this study was conducted using a mixed-method design, the collection of qualitative data requires the researcher to determine her role in the study. The primary focus of the researcher in the qualitative research is to capture authentically the lived experiences of people created in the social text written by the researcher, helping to confront the problem of representation within a framework that sometimes makes the direct link between experience and text problematic (Denzin & Lincoln, 2005). Adhering to this focus makes the research trustworthy and valid. In order for the researcher to create an atmosphere that fosters the characteristics of being valid, the researcher must view her own subjectivity and examine the topic from a neutral viewpoint. Creswell (2003) encouraged researchers to "clarify the bias the researcher brings to the study. This self-reflection creates an open and honest narrative that will resonate well with readers" (p. 196). When the researcher is speaking in the name of people or objects, the listeners must understand that you are representing only yourself in order to be subjective. It has been said that the relationship between objectivity and subjectivity are relative to trials of strength. Meaning, objectivity and subjectivity can shift gradually, moving from one to the other, similar to the balance of power between two armies (Latour, 1987).

Peshkin (1988) claims that one's subjectivities can be seen as virtuous; for it is the basis of researchers making a distinctive contribution that results from the unique configuration of their personal qualities joined to the data they collected. Eisenhardt (1989), Miles and Huberman (1994), Yin (1994), Lincoln and Guba (2000) also have explained the influence of a researcher's subjectivity on qualitative research. The researcher is a veteran teacher with 11 years of professional experience with curriculum and instruction, plus additional years as a science classroom teacher. The researcher's position as an educator in biological sciences provided personal interest in the study. During data collection, the researcher conducted interviews in which the responses were of significance for both teacher and researcher. The researcher's own biases as an educator were examined and recognized prior to and during the study and data analysis. Ultimately, an attempt was made for the researcher to have minimal bias on the outcome of the research study. It is not uncommon for researchers to conduct a study involving a topic in which they have a strong interest. This study was a great example of such an instance.

Instruments and Data Collection Protocols

Two quantitative instruments and several qualitative protocols were used for this study. The quantitative instruments were the QEST and the QAPEST. Both were developed using the STIN (Zurub & Rubba, 1983). The qualitative data collection protocols included the *Interview Protocol for Exemplary Science Teachers* (IPEST), the *Interview Protocol for Administrator Perceptions of Exemplary Science Teachers* (IPAPEST), and lesson plans collected from EZ Lesson Plan. Guidance from the review of literature was used to help formulate the questions of the STIN into the QEST, QAPEST, IPEST, and IPAPEST.

The questionnaire and interview protocols were designed by the researcher and were tested for trustworthiness, authenticity, and credibility with two science teachers not included in the case study. Teacher volunteers reviewed the questionnaires and interview protocols, and items were modified to clarify any comprehension or bias that could be formed inadvertently from the questionnaire or interview protocol items. The purpose of this procedure was to improve, modify, rearrange, or revise the questionnaire and interview protocol for optimal clarity.

The questions on the QEST, QAPEST, IPEST, and the IPAPEST were composed in order to encourage participants to rate the importance of science instruction and determine the educational and experiential backgrounds that helped the teacher and administrator foster success for the students in a school science program. The specific areas included examined attitudes on the importance of science related to the science teacher's ability to specify objectives for science, diagnose and evaluate learners for science instruction, plan for science instruction, and deliver science instruction.

Other quantitative data included student achievement data that were collected to examine the EST's impact on students. These data were gathered from Mississippi Student Information System (MSIS) and the Mississippi Accountability and Assessment System (MAARS).

Questionnaires

The QEST and QAPEST included items that allowed the researcher to assess the EST's and administrator's perceptions of the importance of science instruction. These questions were developed using the STIN (Zurub & Rubba, 1983).

> Items on the STIN are organized into seven categories: (1) specifying objectives for science instruction, (2) diagnosing and evaluating learners for science instruction, (3) planning science instruction, (4) delivering science instruction, (5) managing science instruction, (6) administering science instructional facilities and equipment, and (7) improving one's competence as a science teacher. (Zurub & Rubba, 1983, p.17)

Four categories were selected from the STIN as the focus for the questionnaires. Permission to use the STIN was granted to Mississippi State University (MSU) Library for any student. A copy of the permission correspondence can be found in the appendix section.

Interviews

According to Bogdan and Biklen (2007), it is wise for researchers to include semi-structured interviews in which the same general questions or topics are brought up to each of the subjects involved because it provided a comparison among participants' responses. Therefore, interviews were conducted with the teacher and administrator. The interview protocols for the teacher and administrator were developed using the STIN. Because the STIN allows for open-ended statements, the STIN as a questionnaire instrument was readily converted into an interview protocols. Using the IPEST and the IPAPEST, the researcher was able to gather more in-depth information from the teacher and administrator to ensure that the participants' voices were represented.

Lesson Plans

Lesson plans were collected from the EST to determine the extent to which the teacher specified objectives for science instruction and planned for science instruction.

Student Achievement Data

Student achievement data in the form of Biology I course grades and SATP scores were collected to determine whether the students taught by the EST experienced success. While this data were not used to focus a specific research question, they were used to determine the teacher's exemplary status.

Trustworthiness

Creswell (2003) explained that it is the responsibility of the researcher to validate the accuracy of his or her findings. Unlike quantitative research, reliability and generalizability play a different role in qualitative research. The strength of qualitative research is validity. Validity is used to determine whether the findings are accurate from the standpoint of the researcher, the participant, or the readers of an account (Creswell & Miller, 2000). Therefore, terms such as trustworthiness, authenticity, and credibility play an important role in qualitative research. Validation of qualitative research findings occurs throughout the research process. Therefore, reliability and generalizability are not viewed the same in research qualitative. Creswell (2003) referenced the following eight ways to help ensure validity: triangulation, member-checking, detailed description, identification of biases, discussion of discrepant information, prolonged engagement in the field, peer debriefing, and an external auditor. The following were used for this study: triangulation, member-checking, detailed description, identification of biases, and peer debriefing.

Procedures

There are several procedures included in conducting research. Before data collection began for this study, the protocol was submitted to the Institutional Review Board for the Protection of Human Subjects in Research (IRB). The MSU IRB granted permission for the study to take place. Additional permission was obtained from the school-district superintendent and principal of the high school. After permission was obtained from the IRB and the local school district, the researcher began the process of conducting the study. A list of the steps followed by detailed description are included below.

- First, the MSIS and MAARS were used to collect student achievement data for the science teachers at the selected school. The data were analyzed to determine which of the teachers was identified as exemplary based on the students' success.

- Second, the teacher identified as exemplary was contacted to determine her interest in the study. Once she stated she was interested, she was asked to identify an administrator that she felt had been supportive of her endeavor in fostering success for her students.
- Third, the selected administrator was contacted to inquire about his interest in the study. The administrator agreed to participate in the study.
- Fourth, once the EST and the administrator agreed to participate in the study, the researcher began the process of data collection.
- Fifth, the researcher had the participants complete the QEST and the QAPEST and analyzed the completed questionnaires.
- Sixth, the researcher conducted interviews with each participant, transcribed the interview recordings, and provided the participants with copies of the interviews for member checking.
- Seventh, the researcher analyzed the transcripts and cross referenced the findings with the findings from the QEST, QAPEST, and the lesson plans.
- Eighth, the researcher drafted the final dissertation and completed the final dissertation defense.

Creswell (2003) noted that involving participants in all facets of the research is necessary in research that involves qualitative data collection. It is for this reason that an introductory meeting with the teacher and administrator was held in the high school science laboratory after school hours. The researcher personally invited the teacher and administrator to attend the meeting and provided them with a detailed cover letter explaining the case study. This cover letter was in addition to the researcher explaining the purpose and procedures of the study along with the invited participants' role. The participants were allowed to ask any questions that they had at the time of the introductory meeting. Both participants were asked to sign an Informed Consent for Participation in Research

After signing the informed consent, the participants were given a copy of the questionnaires. To ensure confidentially, the participants were provided with a large business-size envelope in which to place their completed questionnaire. To convenience the participants, the researcher gave both participants a choice of completing the questionnaire at the time of the meeting or at a time and place that was convenient for each participant. Also, both participants were given one week to complete and turn in the questionnaire if they chose to complete it at a time other than during the introductory meeting.

Interviews were conducted and mutually scheduled at convenient times after school with the EST and administrator. Again, to maintain the participants' confidentiality during classroom visits for interviews, the classroom doors were closed. It is part of the researcher's daily duties to visit and evaluate teachers; therefore, the frequent visits to the classrooms helped to minimize any unwanted attention or stress on the participants. The interviews lasted approximately one hour and were electronically recorded for transcription. It was important during the interview for the researcher to provide a relaxing environment and to speak in a calm, relaxing manner. The researcher remained objective when asking questions that required the participants to dwell more on a topic. This helped the interviewees' conversation and ideas continuously evolve. The use of open-ended questions also helped with the intention of encouraging the participants' in-depth thinking and making connections to their classroom experiences.

By choosing an EST to interview, it was the researcher's intention that the participants be committed to and invested in a topic in which they share a common interest. The interviews, along with follow-up member checks and the use of multiple data sources with each participant helped to ensure the detailed description that the study displayed. This was done according to Gay and Airasian (2003) using the method of triangulation to corroborate the data. The different data sources produced the same descriptions of an event or the same answers on different documents.

Although ethical policies and guidelines exist for collecting qualitative research, Creswell (2003) suggested that the researcher must understand and anticipate that harmful information might be disclosed during data collection. It is the ethical responsibility of the researcher to protect the privacy of the participants and to convey protection to everyone who is involved in the study. For this reason, the researcher kept all data collected as confidential records. The data collected complied with the IRB guidelines. Data were kept in a locked filing cabinet located in the researcher's office. The records will be kept for one year and subsequently destroyed by shredding. Nevertheless, actual ethical practice comes down to the individual researcher's own values and ethics (Merriam, 1998).

Data Analysis

Gay and Airasian (2003) stated, "Although research results often lead to new questions to examine, the primary intent of action research is to use collected data to alter or improve teaching practice" (p. 272). The data analysis in this study was guided by detailed procedures designed to establish relationships among categories of data using triangulation to merge the data. In this case study, the researcher analyzed data in four stages: analyzed existing data, analyzed questionnaires, analyzed interviews and provided examples of the four categories, and conducted a member check. Data analysis involves creating categories that will ultimately narrow the researcher's findings to a few key categories or features (Gay & Airasian, 2003, p. 272).

Stage one of the data analysis involved analyzing existing data (test scores on SATP, Biology-I class grade, and lesson plans) in order to select the school participants who would serve as the case to study. The test scores and class grades were organized into tables by classes and the periods that the students attended the EST's class. The lesson plans were categorized into high, medium, and low status according to the amount of information provided within the lesson plans.

Stage two of the data analysis involved the analysis of both participants' questionnaires in order to gather the participants' responses. The questionnaires consisted of four categories: specifying science objectives, diagnosing and evaluating learners, planning science instruction, and delivering science instruction. The questionnaires were organized into a table that displayed a summary of the numerical average of the participants' responses to each of the four categories of science instruction. Afterwards, follow-up questions were composed by the researcher based upon the participants' responses for further in-depth responses.

Stage three of data analysis was the interview. An interview of each participant lasted approximately one hour. The interview was conducted in order to gather the participants' responses in a more in-depth manner. The follow-up questions developed from the questionnaires were used during the interview and provided the researcher with a richer description. The interviews were transcribed by the researcher from the electronic recording using the Dragon software. All pages and transcribed lines were numbered to enhance references made by the researcher in this study. Also, during this stage the researcher provided the participants with the use of examples for the four categories of science instruction as a lens through which to interpret the interview.

Stage four of the data analysis involved the researcher scheduling and performing a member check with the participants to ensure that the participants' voices are accurately heard. The researcher provided a table displaying the research questions, sources of data, and analysis techniques used in this study.

Summary

The researcher sought to include the voice of the EST and administrator as they commented on science instruction, just one of many responsibilities they possess as educators. The researcher collected their experiences and opinions by using a mixed methods design. The method of data collection involved the use of existing data (test scores, class grades, and lesson plans), a questionnaire, a semi-structured interview, and examples of the four categories of science instruction. The participants were allowed to comment on any training and personal experiences that related to the study. Existing data and member checks were used to triangulate the data. The research was conducted in an ethical manner by complying with IRB guidelines to ensure ethical rigor.

CHAPTER IV

THE RESULTS OF THE STUDY

Introduction

This study was conducted to examine the practices utilized by one exemplary EST at Langsdale High School to promote success for her students and to identify the administrative practices that supported her. At Langsdale High School, graduation requirements specify that all students pass Biology I and the state mandated Biology I subject area test (SATP). To achieve this task, collaboration among students, teachers, and administrators must exist to secure the success on SATP, which affects the school and district's accountability ratings. Relevant data regarding the case of the EST and her chosen administrator were collected. The data collection procedures included existing data, questionnaires, and interviews with subsequent validity and reliability addressed using member checks and triangulation of data.

The results of the data analysis are presented in this chapter. Data gathered for each of the research questions are included in the chapter followed by an overall analysis of the data in response to the primary research question. The chapter concludes with a summary of results.

Research Questions

The researcher sought to answer three research questions using quantitative and qualitative data.

Quantitative

1. How do an exemplary high school science teacher and her selected supporting administrator rate the importance of particular elements of science instruction?

Qualitative

2. How does an exemplary high school science teacher describe fostering success for her students as she specifies objectives, diagnoses and evaluates learners, plans and delivers science instruction?
3. How are the administrative practices that support an exemplary high school science teacher described?

Participants' Profiles

The Case: The Exemplary Science Teacher

At the time of data collection, the EST had been teaching for 12 years. She was a middle school science teacher for seven years and high school Biology I teacher for the past five years. Her quiet demeanor and zealous attitude showed her ability to captivate a classroom full of eager learners. She was over filled with great joy as she helped a child unlock the world of science as he or she learned to make connection with the scientific knowledge that one did not know lived within them. Her colorful, organized classroom was decorated with many personal touches as well as students' displayed work and personal items. Her gleaming smile paved the entrance of her classroom to let the students know that she cared and understood them. The exemplary science teacher received numerous parent and student requests for her class. The administrators and teachers selected the exemplary teacher as teacher of the year. Regardless of her busy schedule, the exemplary teacher attended student events such as football games, basketball games, soccer games, and student council events within the school and church events in the community consistently. The teacher graduated with a Bachelor of Science degree from Mississippi University for Women with a teacher certification in math, science, biological sciences, and computers. She obtained her National Board Certification in science. With personal experience as a science teacher, the EST felt very strongly about her choices on the questionnaire in regards to the importance of specifying science objectives, diagnosing and evaluating science instruction, planning and delivering of science instruction.

The Chosen Administrator

The EST's chosen administrator was a former middle and high school math teacher and coach for five years. His first administrative job was as the assistant principal at Langsdale High School for three years. He then became the principal of Langsdale Junior High School for three years. He was later named the principal of Langsdale High School for the next three years. He is presently serving as the principal of another high school in Jackson, Mississippi. His demeanor and tenacious attitude enabled him to captivate both teachers and students who were eager to grow and achieve success. He was passionate and lit up with an over-sized smile as he helped a child or teacher discover the power of achieving the impossible. His educational philosophy was to improve the quality of life for students through education and building relationships. The administrator graduated and received all of his higher learning from Mississippi College: Bachelor of Science in mathematics, Master of Science in mathematics, and Education Specialist in educational leadership. With personal experience as a math major, having to take several hours of science courses and as an instructional/educational leader, the administrator felt very strongly about his choices on the questionnaire in regard to the importance of specifying science objectives, diagnosing and evaluating science instruction, planning and delivering of science instruction.

Quantitative Research Question Findings

The quantitative research question asked, *How do an exemplary high school science teacher and her selected supporting administrator rate the importance of particular elements of science instruction?* In response to the quantitative research question, data analysis are provided as collected from both participants regarding the questionnaire using a rating of importance from 1 to 4 (1= not important, 2 = minimally important, 3 = moderately important, 4 = highly important, and NF = not familiar with task). The EST's responses to the QEST and the administrator's responses to the QAPEST are discussed in the sections that follow.

Exemplary Science Teacher QEST Responses

The EST rated all five components in regard to the importance of specifying science objects with the highest rating of 4. The EST felt that it was highly important for science to be taught in school, to have an established science curriculum/program, to have content knowledge of previous science courses, to have objectives for science knowledge, to have attitudes and skills for students to develop as scientists, and to have science objectives arranged in the sequence they will be addressed in the lessons. The EST commented, “Objectives give both the teacher and student a clear direction of what knowledge they should (student) gain.”

The EST rated both components in relation to the importance of being able to diagnose and evaluate learners for science instruction in her classroom with the highest rating of 4. The EST felt that it was highly important for a teacher to design assessment items/procedures that validly assess science instruction and that the assessment data be used to determine students’ readiness or difficulties in the classroom. The EST commented, “Assessment, both informal and formal, are vital in indicating remediation and enrichment for each individual student.”

The EST rated both components regarding to the importance of planning for science instruction the highest rating of 4. The EST felt that it was highly important for a teacher to use student-readiness data to plan for science instruction. The EST commented, “Pre-test data allows a teacher to target the objectives at the level needed for their class.” The EST felt that four of the five components in regards to developing an instructional plan were highly important. These components were instruction for a single session, selection of instructional strategies, preparation of teacher-made instructional materials, and arrangement of the class/lab. The EST commented, “It is easy to lose a class or lab if not arranged properly.” However, the EST felt that the selection of commercially prepared instructional materials was minimally important to the planning of science instruction.

The QEST consisted of three major questions related to the importance of delivering science instruction. The first question examined the teacher's perceptions on the importance of motivating students to learn. The EST rated the importance of motivating students to learn science as highly important. The EST commented, "Motivation equals higher success."

The second question consisted of 11 components in regards to the importance of using certain science instruction delivery techniques. The EST rated the following seven science delivery techniques as highly important with a rating of 4: inquiry teaching strategy laboratory, lecture/illustrated talk, demonstration of concept, process skill, or manipulative skill, individualized instruction, group/panel discussion, and peer tutoring. The EST commented, "Science is inquiry. All four (specifying objectives, diagnosing and evaluating learners, planning, and delivering science instruction) of the above are vital for each main objective taught--inquiry, laboratory, lecture/illustrated talk, demonstration of concepts, process skill, or manipulative skill." However, the EST rated simulation technique, team teaching, and value clarification strategy as moderately important with a rating of 3. Nevertheless, the EST felt that team teaching is "vital for special needs." Though rated as minimally important, the EST did feel that field trips were important as a science instruction delivery technique.

The third question surrounded the importance of using certain science instruction delivery techniques such as audiovisual, equipment, computers, and/or the library/media center was rated as being highly important by the EST. The EST responded, "This is a requirement for kids in 2016."

Administrator QAPEST Responses

The administrator rated all five components related to the importance of specifying science objects the highest rating of 4. The administrator felt that it was highly important for science to be taught in school, to have an established science curriculum/program, to have content knowledge of previous science courses, to have objectives for science knowledge, to have attitudes and skills for students to develop as scientists, and to have science objectives arranged in the sequence they will be addressed in the lessons.

The administrator rated both components in regards to the importance of being able to diagnose and evaluate learners for science instruction in the classroom with the highest rating of 4. The administrator felt that it was highly important for a teacher to design assessment items/procedures that validly assess science instruction and that the assessment data to be used to determine students' readiness or difficulties in the classroom.

The administrator rated both components in correspondence to the importance of planning for science instruction the highest rating of 4. The administrator felt that it was highly important for a teacher to use student-readiness data to plan for science instruction. The administrator felt that four of the five components in regard to developing an instructional science plan were highly important. These components were instruction for a single session, selection of instructional strategies, preparation of teacher-made instructional materials, and arrangement of the class/lab. The administrator commented, "It's necessary for classroom management." However, the administrator felt that the selection of commercially prepared instructional materials was moderately (rating of 3) important to the planning of science instruction. The administrator commented, “Sometimes, wrong material and level.”

The QAPEST consisted of three major questions in regard to the importance of delivering science instruction. The administrator rated the importance of motivating students to learn science as highly important.

The second question consisted of 11 components in regard to the importance of using certain science instruction delivery techniques. The administrator rated the following five science delivery techniques as highly important with a rating of 4: inquiry teaching strategy laboratory, demonstration of concept, process skill, or manipulative skill, simulation technique, and individualized instruction. However, the administrator rated field trip, team teaching, value clarification strategy, group/panel, and peer tutoring moderately important with a rating of 3. The administrator felt lecture and illustrated talk is minimally important with a rating of 2.

The third question in regard to the importance of using certain science instruction delivery technique such as audiovisual equipment, computers, and/or the library/media center was rated as being moderately important by the administrator.

Analysis of Exemplary Science Teacher and Administrator’s QEST and QAPEST Responses

A comparison was made between the responses summarized from the QEST and the QAPEST. The questionnaire data suggest that both participants, EST and her chosen administrator, deem the importance of science teachers specifying objectives, being able to diagnose and evaluate learners for science instruction, planning science instruction, and delivering of science instruction for science teachers to be successful in helping students. The participants' responses regarding the importance of specifying objectives for science instruction, diagnosing and evaluating learners for science instruction, planning science instruction, and delivering science instruction are summarized in Table 4.

Table 4

Questionnaire Response Average Rating Comparison for Secondary Research Questions

Element of Science Instruction	Avg. Teacher Rating	Avg. Administrator Rating
Specifying Objectives	4	4
Diagnosing and Evaluating Students	4	4
Planning Instruction	3.5	3.8
Delivering Science Instruction	3.6	3.46

A summary of the data from the questionnaires show that the EST and her chosen administrator rated the importance of science instruction in the areas of specifying objectives, diagnosing and evaluating learners for science instruction, planning, and delivering of science instruction very closely. Though they may have some differences in the planning and delivering of science instruction, both agree the two are moderately important.

Qualitative Research Question Findings

The two qualitative research questions for this study were, *How does an exemplary high school science teacher describe fostering success for her students as she* *specifies objectives, diagnoses and evaluates learners, and plans and delivers science instruction?* and *How are the administrative practices that support an exemplary high school science teacher described?* These questions were answered using interviews, lesson plans and class data. Responses from the EST and her chosen administrator were framed using the STIN as a reference to create the IPEST and the IPAPEST. After the interviews were conducted and transcriptions were reviewed, a number of recurring themes were identified to answer the qualitative research questions. A discussion of the findings for each research question was included in the following sections.

Theme 1: Fostering Success through Elements of Science Instruction

The EST and the administrator felt the teacher was able to foster success through the four areas mentioned – specifying objectives, diagnosing and evaluating learners, and planning and delivering science instruction.

Exemplary science teacher response. When specifying objectives, the EST always relied upon Mississippi Department of Education framework as the primary resource. The EST also used other resources such as state practice tests as well as out-of-state state practice tests because sometimes the test questions in other secondary resources may not be at the proper level or were written incorrectly. The EST believed that it was highly important for her and other science teachers not only to be aware of the science instruction components used for specifying objectives but also to implement the science instruction components into their daily actions when teaching. Also, when specifying objectives the EST stated,

> If you don't know where you are ending up, then where do you know where to begin? Both teacher and student need to understand where you are going with this skill. Back-loading is important in education because the teacher must keep in mind what skills have to be covered, especially in tested classes so you can properly teach them throughout the year. Specifying objectives are done by using the state objectives, posting them daily on the board so that students can understand them because they are wordy, and giving a general overview of the day's objective because they are long and you won't cover an objective in its entirety in a day. (transcription p. 2, lines 47- 50; p. 3,lines 59-61; p. 3, lines 65-73)

In regards to being able to diagnose and evaluate learners for science, the EST felt that assessment data should be used frequently to determine student readiness or toned for remediation and enrichment. The EST stated that it was highly important to use assessment data so that the teacher could correctly guide each individual student. The teacher said that the assessments could be formal or informal. She made it a point to emphasize that neither remediation nor enrichment had to be long, yet must be consistently done. The teacher stated,

> It can be simple, like your pre-bell from the day before, or it can be something from earlier in the year to strengthen their science skills. For example, when we test we always give them some previous knowledge from other units throughout the year on their tests because we are all human and we forget. The students can easily lose those skills. (transcription p. 4, lines 89-96)

The EST also said that it was highly important to have a simplistic way to quickly analyze student data such as a scanning system that read and identified objectives, giving both the student and teacher quick analysis. The teacher felt that this would lead to more effective planning for remediation and enrichments by teachers.

When planning for science instruction, the EST explained that it was extremely important to use the data when remediating. She felt that by using the data she could avoid wasting instructional time remediating mastered skills. Planning serves as a roadmap. She often commented about knowing where one is going and how one is going to get there. If the majority of class did well, there was no need to do extensive remediation, only as needed on an individual basis. She thought that analyzing the data allowed her to identify pertinent skills (not just for state test but for ACT or other educational reasons) that needed remediating and assisted her in planning efficiently to meet the needs of the students. When asked, what should remediation look like and when have she found it to be most successful, the EST stated,

> It has to be used in multiple formats to be overall successful. You have to put it your pre-bell when discussing it with the class, in test questions or assessments, you have to put it in your labs or in your daily work. So, written and verbal assessments are necessary throughout the year. (transcription p. 5, lines 115-120)

Also, the EST mentioned when planning, it was important to use pre-tests for her state tested classed or a class needed for graduation in pin-pointing where students are struggling. If teachers do not know, then they cannot help a student to be successful and you don't know what they need. Having a pre-test on a large or small scale is instrumental when it comes time to take assessments, state tests, or ACT. Pre-tests are also used to help the EST in planning her groups in class (low or high ability).

The process used by the EST when planning a pre-test included looking at practice books that are written at the appropriate level, changing test questions up to mimic the state test, formatting questions to look like state test questions, using higher order questions from the enrichment plus book, and including several questions on the assessment from all sub-objectives. The EST was adamant about protecting her instructional time because the science curriculum is very broad. Therefore, the selection of instructional strategies and commercially prepared instructional materials was carefully done because instructional strategies and commercially prepared materials were not always written at the appropriate level. The lower written level of the materials causes students not to be properly prepared for higher order questions.

The EST said that post-test data had its place in a teacher's planning. The EST felt that sharing and teaching the students how to read or interpret test data after an assessment was important in the planning process for upcoming assessments, remediation, or enrichment, as well.

The last area that the EST viewed as highly important for planning was the arrangement of classroom or lab. The EST stated,

> It could change from week to week. I have had times where kids are perfectly fine sitting by one another and times when they hated each other, causing conflict with the whole classroom. I have found that it is best to change the seating chart multiple times, like every three or four weeks. For me, I change twice in a nine weeks. However, I change more at the beginning as I learn the students that are struggling so that I can move them to the front. You want your kids to be comfortable because if not, they can't focus. Also, it is important being able to

place yourself in the classroom to minimize distractions so that students feel safe (transcription p. 7-8, lines 188-203; p.8, lines 212-218).

In regards to the delivery of science instruction, the EST understood the importance of using multiple delivery strategies. Although she mixed her strategies between lecture, demonstration, inquiry, groups, and individualized strategies, the EST felt that science is so hands on that it provides students with interactions and explorations that other classes do not. The EST felt the strongest and most important delivery strategy was the use of technology. The EST was very knowledgeable with technology and used it daily in her classroom. This may be seen or done in the form of using the smart board, student interactive clickers or laptops to complete a virtual lab. The EST was not afraid to rely upon the students' help in the world of technology. This practice allows for engagement and gives the students a sense of ownership and control in the classroom in front of their peers.

The EST took the standpoint that it was very easy to motivate students in science because the use of technology makes science even more accessible. Once a teacher incorporates the many different hands-on activities, 'there is no way' a student does not become motivated, engaged, or curious for more. The EST stated that technology gives students the opportunity to get up and move around the room in an organized manner. In the interview, the EST stated, "This is a requirement for 2016. Technology is what kids see every day. They can teach us more than we can teach them. Weekly, there has been a kid that has helped me with technology" (transcription p. 15, lines 394-395, 397-398).

Chosen administrator response. The administrator also reiterated the points made by the EST. When specifying objectives the administrator said that although state practice tests, other out-of-state tests, pre or post assessments and state standards are helpful resources, one must understand that math and science are presently driving the world's economics. The administrator also relied on Mississippi Department of Education framework as the primary resource tool. However, he allowed the EST to use secondary resources such as the blueprint for the Biology I SATP that listed the number of questions for each objective tested and practice SATP test booklets. Teachers were also allowed to use the district's science curriculum or program that was constantly evaluated by the administrator and other science teachers to establish the best time line and order of sequence for the curriculum to establish a well written pacing guide.

The administrator explained that if a teacher is struggling with specifying objectives,

> It is more important for a struggling teacher to see themselves and critique themselves through self-observation via video, use co-teaching, and department heads to help guide and point them in the right direction. It will be more receptive and far better than the administrator evaluating them. (transcription p. 4-5, lines107-119)

In regard to being able to diagnose and evaluate learners for science, the administrator felt that the use of assessment data to determine student readiness or difficulties in regards to remediation and enrichment does not have to be daily. Remediation and enrichment depend on the standards and students testing. This will provide teachers with clear directions. However, it is a great part of what teachers do in the class and must be part of their planning for science instruction. The administrator stated,

> It is important to use the numbers to guide or dictate the instruction. If you don't know your clientele, you are spinning your wheels. You must know where you are going and that is what the pre and post-tests allow you to do. You have to develop individual plans for students. The data determines what, how, and when you remediate. It depends on the standards and students you are testing. Differentiation should take place to build in a lesson for another lesson for struggling students (transcription p. 7, lines 166-169,179-182).

When planning for science instruction, the administrator continued to express his feelings on the importance of using data when remediating. He, too, felt using data would save instructional time. Knowing when to remediate or to re-teach a lesson takes effective planning. Data inform the EST what type of students she has such as high fliers (high achievers), middle (average achievers), or low (struggling learners). The administrator stated,

> We are trying to get the most out of each individual not the most out of the class. This is what data do for teacher planning. If a teacher does not know what the data are saying, she cannot plan specifically for individuals. This will grow students to be more college and career ready and increase ACT scores (transcription p. 8, lines 208-211; p. 8-9, lines 223-225).

The administrator viewed that the selection of commercially prepared instructional materials was moderately important because it plays a role in specifying objectives. At the same time, it is up to the administrator and EST to make sure that they are at the appropriate level or rigor and to use them within the lesson where most appropriate for all students according to where they are. Often, the administrator feels that the commercially prepared materials are written on Bloom's (2001) lowest level of instruction for testing at a depth of knowledge that focuses on recalling information. The order of sequence is sometimes not the best flow and needs adjusting because it pushes students in a general direction that does not lead students into higher science after high school. The teacher must have flexibility to make changes within the sequence or table of contents.

The last area that the administrator responded to as being of high importance for planning was the arrangement of classroom or lab. Generally, the administrator believed that many teachers stand at the front of the class conducting whole class teaching. The administrator stated,

> Teachers that are successful don't use a traditional setting in the classroom. They are all over the place. Classroom arrangement should be unique based on the types of learners that are in the classroom. Again, using the assessment data to drive or specify objectives and students' needs. This will create a classroom environment that is conducive for everybody being successful. The teacher should be all around the room, guiding instruction. Every inch of the classroom should be used as an instructional tool. In order not to have a traditional classroom, a teacher must have good classroom management (transcription p. 13, lines 330-333, 337-341, 343-350).

In reference to the delivery of science instruction, the administrator believed in the use of multiple delivery strategies and deemed inquiry, laboratory, demonstration, simulation, and individualized teaching as the most important delivery techniques. However, the administrator did not feel as strongly about technology. Although it is important for competition and the students use it every day for social media, technology should only be used to enhance science instruction but can never replace what a student can actually engage in through hands-on activities and field trips. The administrator felt that science provided both teachers and students with many opportunities because of the hands-on- activities. He compared the use of hands-on activities in science to practicing a sport that he coached. He said,

> Practice over anything should not be punitive. It is just what it is. Practice. To test your hypothesis to get your results. It's like testing your hypothesis and going through the scientific method. Doing it step-by-step. That's what hands-on allows you to do. Practice, doing it to get better. (transcription p. 14, lines 365-371)

Although he felt that lecture/illustrated talk was the least or minimally important and least effective, he found that most teachers used this delivery technique because it is the technique with which they are most comfortable. Teachers are afraid to venture off and try new techniques. It is also the easiest delivery technique for a teacher to use. He feels that lecture should never last over 12 to 15 minutes or the teacher will automatically lose the students due to lack of engagement and their short attention span. In the interview the EST stated, "A teacher should use multiple delivery techniques to incorporate all the different learning styles in the classroom" (transcription p. 15, lines 383-384).

During the interview, the administrator stated that field trips are an important delivery technique because it provides students a first-hand experience of what the teacher is trying to get them to see and accomplish in the classroom. The students can actually see the concepts come together, rather than a vicarious experience provided by the teacher. He stated, “The students can now see it, smell it, and have a better understanding for why the process is what it is” (transcription p. 15, lines 401-402).

Although the administrator felt that team teaching and group/panel discussion were moderately important, he felt they are often not correctly used nor have teachers been properly trained to utilize them effectively. He felt that during his time as an administrator, he most often has seen team teaching carried out as,

> One teacher lectured while the other teacher is a glorified teacher assistant in the classroom. It has not worked out as it was supposed to. It would be effective if there was training to facilitate that learning environment (transcription p. 16, lines 418-423).

Theme 2: The Value of Relationships

During the interview, the administrator discussed his beliefs about different relationships that are found in the school. In particular, student-teacher and teacher – administrator relationships were discussed. The administrator also credited his previous coaching for contributing to him building positive relationships with both the teachers and students. As an educator, the administrator loves what he does and feels that all educators should love doing what they do because school is like an ‘oasis’ away from home for most of the children at his school. Sometimes, the administrator and teachers are the only positive adult that most of the students see. The students experience abuse in many different ways. School gives them an opportunity to reinvent themselves and have a home away home. However, the administrator feels that there is unintentional bias that is a barrier when teaching African-American students because most of the teachers at his school do not come from the same background as the students. Therefore, they do not understand the students. This is why building relationships are so important.

Relationships help the teacher to learn and understand the students in a different way from academics. The administrator feels that is why student council and other student led organizations should be in schools to give students a voice. The administrator felt that the EST took it upon herself to use sports and anything else that the students loved to her benefit in the classroom to get the most out of the students. He referenced that,

> It is no doubt in my mind that having positive, appropriate relationships with the students helped contribute to the exemplary science teacher's success with African-American students and any other students because when they look up from the football field, basketball court, and most definitely at homecoming—led by the exemplary teacher, they see her. They know that she cares. She is not only part of school activities, she is out and plays a major part in the community and at church where these students are. They feel that she is one of them, not as a kid but someone who cares. She keeps up with the students after graduation and some enter into science fields because of her. Students feel that her classroom is a non-threatening environment and that she has their best interest in mind. They want to succeed for her and not necessarily themselves because of preconceived notions that they have about teachers. She raises students' expectations, meets them where they are, and develops relationships. A lot of students come to school wanting to meet the bare minimal and not wanting to succeed. She pushes them

past their level (transcription p. 23-24, lines 594-603).

In correspondence to the EST's success, the administrator shared that her classroom delivery was another key element. He mentioned that her classroom was not a traditional setting. There were a lot of small groups, differentiation of the lessons, and a lot of individual attention. The EST was constantly moving about the room and empowered the students to help others. The students were comfortable and never minded being called upon during any lesson.

Theme 3: Evidence of Planning and Success

In addition to gathering interview responses to identify ways that the EST fostered success, the researcher collected document data via lesson plans and achievement data. This data were used to determine whether the responses of the EST and administrator were represented by evidence. The lesson plans indicated that the EST focused on planning lessons that were content driven and appealed to students' interests, and the achievement data revealed that the EST did foster success based on students' course grades and standardized tests.

Lesson plans. Lesson plans of the EST were collected from Langsdale High School website using ELS Productivity Tool. The state objectives were pre-loaded into the lesson plan system for easy selection. The lesson plans were collected for the school year 2012 – 2013; therefore, only parts of the first semester were recovered. The analysis of the lesson plans showed that the EST planned by the week for all classes. The plans were more detailed at the beginning of the school year and sometimes became scarce toward the middle of the year. The EST acknowledged that she would much rather spend her time planning for her own understanding than putting it on paper for someone else, though she understands it has to be done. The lesson plans showed that the EST used multiple delivery techniques when teaching science instruction as well as gave pretest assessments. Also, the plans showed that the EST used assessment data for remediation or enrichment by having the students do assessment justifications. The EST's lesson plans were written in a word template provided by the school district that followed Madeline Hunter's lesson design model of what effective plans should include. According to Herr (2007), the following components referenced by Hunter make up an effective lesson plan: bell ringer, objectives, vocabulary, hook/set, modeling, guided-practice, checking for understanding, independent work, and closure. Table 5 shows how the components of the school district's lesson plan template unknowingly lined up with the second research question.

Table 5

Comparison of Second Research Question versus District Lesson Plan Template

Element of Science Instruction	**Lesson Plan Component**
Specifying Objectives	Objectives, hook, bell ringer
Diagnosing and Evaluating Students	Guided practice, independent practice, closure, accommodations, vocabulary, bell ringer
Planning Instruction	Guided practice, independent practice, closure, accommodations, vocabulary, bell ringer
Delivering Science Instruction	Modeling, guided practice, independent practice

Figures 1 – 3 are examples of the EST's plan in order from high (most detailed lesson plan), medium (sporadic planning), and low (least planning). The determination of high, medium and low was made b according to the amount of necessary information provided in the lesson plans. A completed lesson plan for each image is located in Appendix H – J.

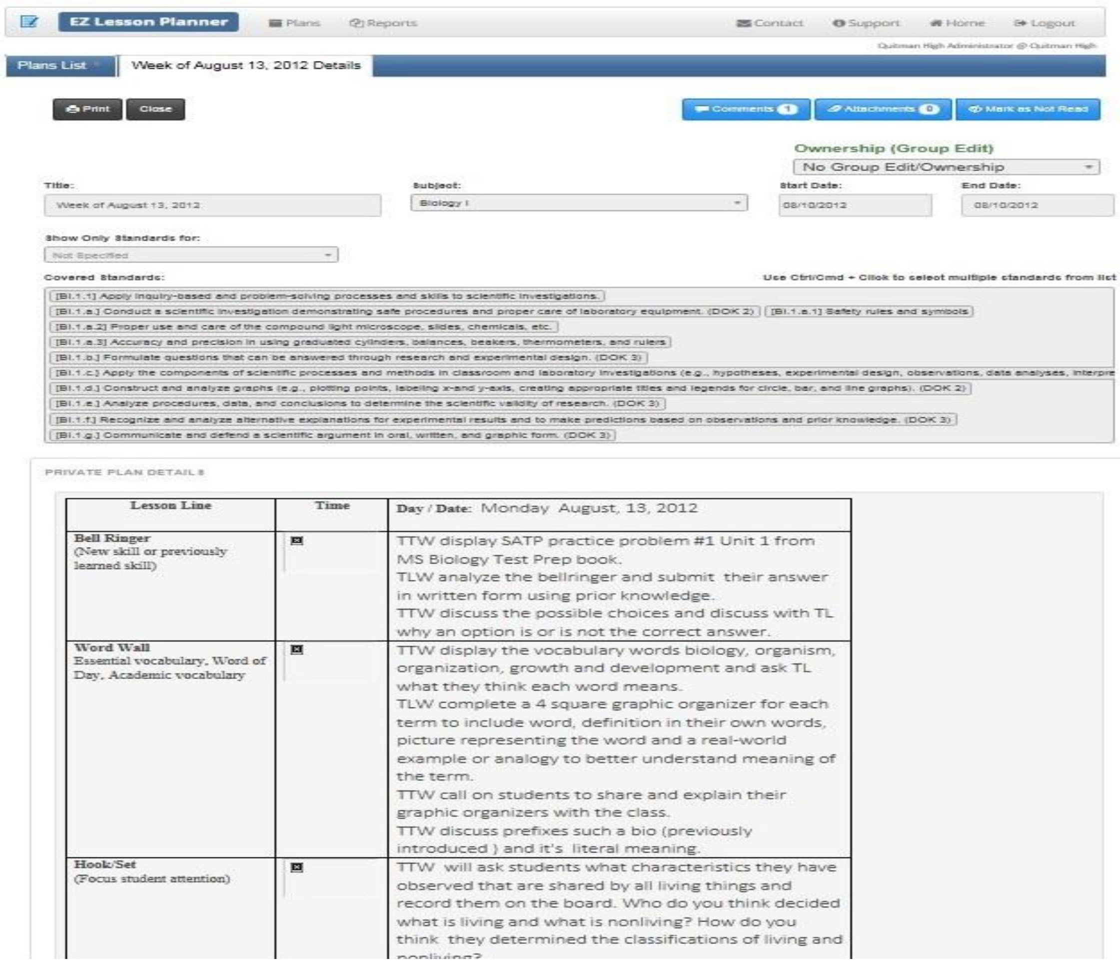


Figure 1. Lesson plan sample depicting high planning status

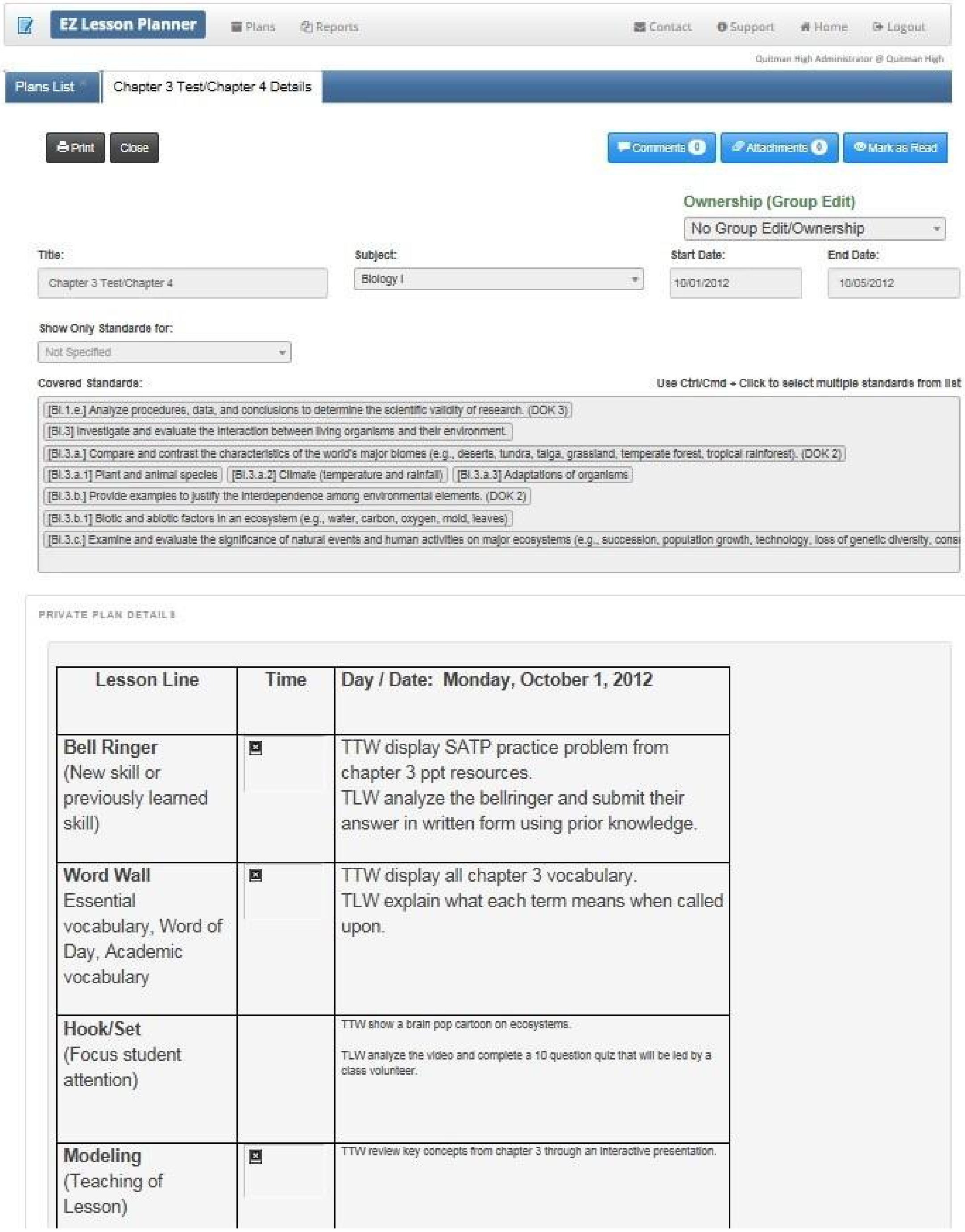
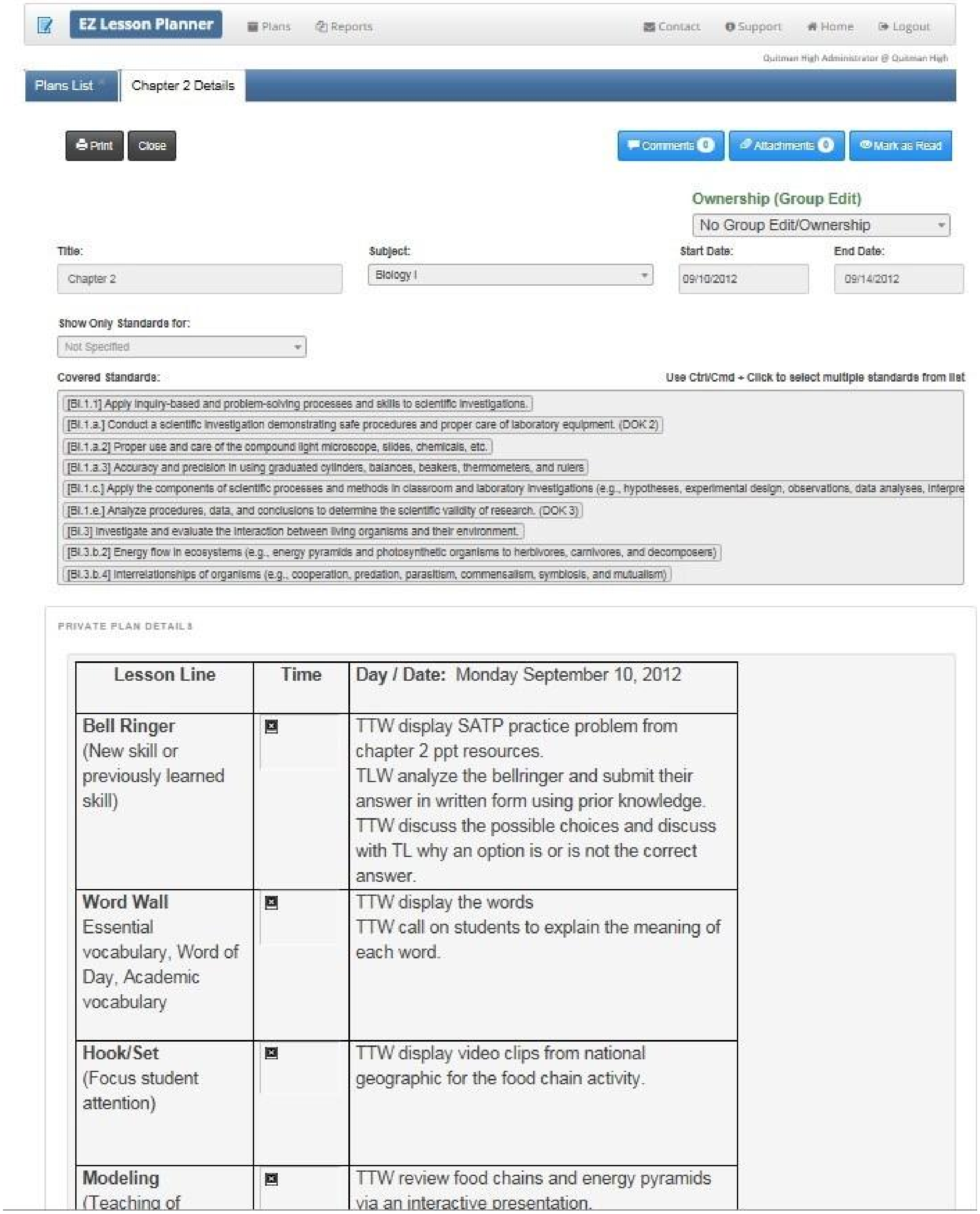


Figure 2. Lesson plan sample depicting medium planning status.



EZ Lesson Planner
Plans
Reports
Contact
Support
Home
Logout

Quitman High Administrator @ Quitman High

Plans List
Chapter 2 Details

Print
Close
Comments 0
Attachments 0
Mark as Read

Ownership (Group Edit)
No Group Edit/Ownership

Title: Chapter 2
Subject: Biology I
Start Date: 09/10/2012
End Date: 09/14/2012

Show Only Standards for: Not Specified

Covered Standards:
Use Ctrl/Cmd + Click to select multiple standards from list

[BI.1.1] Apply inquiry-based and problem-solving processes and skills to scientific investigations.
[BI.1.a.] Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
[BI.1.a.2] Proper use and care of the compound light microscope, slides, chemicals, etc.
[BI.1.a.3] Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers
[BI.1.c.] Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpre
[BI.1.e.] Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
[BI.3] Investigate and evaluate the interaction between living organisms and their environment.
[BI.3.b.2] Energy flow in ecosystems (e.g., energy pyramids and photosynthetic organisms to herbivores, carnivores, and decomposers)
[BI.3.b.4] Interrelationships of organisms (e.g., cooperation, predation, parasitism, commensalism, symbiosis, and mutualism)

PRIVATE PLAN DETAILS

Lesson Line	Time	Day / Date: Monday September 10, 2012
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem from chapter 2 ppt resources. TLW analyze the bellringer and submit their answer in written form using prior knowledge. TTW discuss the possible choices and discuss with TL why an option is or is not the correct answer.
Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display the words TTW call on students to explain the meaning of each word.
Hook/Set (Focus student attention)		TTW display video clips from national geographic for the food chain activity.
Modeling (Teaching of		TTW review food chains and energy pyramids via an interactive presentation.

Figure 3. Lesson plan sample depicting low planning status.

Achievement data. Another piece of existing data that was used for this case study to measure the success of students taught by the EST was the student data from her Biology I classes during 2012 – 2013 school year. The analysis of the EST's lesson plans showed that the EST taught three blocked classes of Biology I on a daily basis for 96 minutes each which included laboratory. This existing data consisted of the students' ethnicity, Biology I class grade, and SATP level of proficiency. The success rate of students in the EST's Biology I class was based upon a student passing the class according to the school district's grading policy and receiving a proficient or advanced on the Biology I SATP. Tables 6-8 display the data using the described color-coded legend: Green represents the students that made an "A" in the class and scored advanced on the SATP, blue represents the students that made a "B" in the class and scored proficient on the SATP, yellow represents the students that made a "C" in the class and scored basic on the SATP, red represents the students who made a "D" or "F" in the class and scored minimal and failed the SATP. The students' ethnicity is represented by using a letter "AA" for African-American or letter "C" for Caucasian. There was no other ethnicity in this class. The EST was successful at helping students be successful in a school science program. She yielded an overall success rate for African-American students in her Biology I class and on the Biology I SATP of 69%. Her overall Quality of Distribution Index (QDI; MDE Accountability, 2012) which measures the distribution of student performance on state assessments around the cut points for basic, proficient, and advanced performance was 186 for the 2012 – 2013 school year.

The class data for Table 6 showed a total of 18 students, with nine of those students being African-American (one student dropped). Surprisingly, no student received an “A” in class and one Caucasian student scored advanced on the Biology I SATP. There were a total of nine students receiving a “B” in the class, but only five were African-American students. A total of 11 students scored proficient but only six were African-American students. There were a total of five students that received a “C” in the class. Two of the five students were African-American and both scored basic on the Biology I SATP. The only “D” made in the class was by an African-American student. However, there was one Caucasian student that scored minimal on the Biology I SATP. There were no failures in the class or on the Biology I SATP for this class of students. There were eight African-American students that passed the class and eight African-American students that passed the Biology I SATP. In Table 6, six out nine African-American students were successful, yielding a 76% success rate.

Table 6

Exemplary Science Teacher Biology I Class Data 2012 – 2013 Periods 1 & 2

Student Name	Ethnicity	Final Grade	SATP Level
Student 1	AA	B	P
Student 2	C	B	A
Student 3	AA	D	P
Student 4	AA	C	B
Student 5	AA	B	P
Student 6	C	C	M
Student 7	AA	B	P
Student 8	C	C	P
Student 9	AA	B	P
Student 10	AA	C	B
Student 11	C	B	P
Student 12	AA	Dropped	N/A
Student 13	C	Dropped	N/A
Student 14	C	B	P
Student 15	AA	B	P
Student 16	C	C	P
Student 17	C	B	P
Student 18	C	Dropped	N/A

Note. Ethnicity: AA=African-American, C=Caucasian, Final Grade: A=90-100 B=80-89, C=70-79, D=60-69, F=59 and below; SATP Level: A=Advanced, P=Proficient, B=Basic, M=Minimal,
* = Failed

The class data for Table 7 showed a total of 16 students, with nine African-American students and seven Caucasian students (one student dropped). There was only one "A" made in the class, and two Caucasian students scored advanced. There were a total of four students receiving a "B" in the class, and they all were African-American. A total of seven students scored proficient on the Biology I SATP, but only four were

African-American students. There were a total of six students receiving a "C" in the class, with four being African-American. There were a total of five students scoring basic on the Biology I SATP, with four being African-American. A total of four students received a "D" in the class, and all four were African-American. However, only one student scored minimal (African-American) and two students failed the Biology I SATP (both African-American). Although the majority of the African-American students' class grade was low, they performed higher on the state test for Biology I. All nine of the African-American students passed the class and seven African-American students passed the Biology I SATP. In Table 7, four out of nine African-American students were successful, yielding a 44% success rate.

Table 7

Exemplary Science Teacher Biology I Class Data 2012 – 2013 Periods 5 & 6

Student Name	Ethnicity	Final Grade	SATP Level
Student 1	AA	C	P
Student 2	AA	D	B
Student 3	AA	C	B
Student 4	AA	C	P
Student 5	AA	B	P
Student 6	AA	C	P
Student 7	C	A	A
Student 8	AA	D	M*
Student 9	C	B	P
Student 10	AA	D	B
Student 11	C	C	B
Student 12	C	B	A
Student 13	C	Dropped	N/A
Student 14	C	B	P
Student 15	C	C	P
Student 16	AA	D	B*

Note. Ethnicity: AA=African-American, C=Caucasian, Final Grade: A=90-100 B=80-89, C=70-79, D=60-69, F=59 and below; SATP Level: A=Advanced, P=Proficient, B=Basic, M=Minimal, * = Failed

The class data for Table 8 showed a total of 23 students, with 14 African-American students and nine Caucasian students (one dropped). There were a total of seven students receiving an "A" in the class, with four being African-American students. A total of six students scored advanced on the Biology I SATP, with only two being African-American. There were a total of seven students receiving a "B" in the class, with five students being African-American. A total of 13 students scored proficient on the Biology I SATP and 10 were African-American students. There were a total of four students receiving a "C" in the class, with two being African-American. There were a total of three students scoring basic on the Biology I SATP, with two being African-American. A total of four students received a "D" in the class and three were African-American.

However, no student failed the class. Only one student scored minimal, and one student failed the Biology I SATP (African-American). Although the majority of the African-American students' class grade was average, they performed higher on the state test for Biology I. All 14 of the African-American students passed the class, and 13 African-American students passed the Biology I SATP. In Table 8, 12 of 14 African-American students were successful, yielding an 86% percent success rate.

Table 8

Exemplary Science Teacher Biology I Class Data 2012 – 2013 Periods 7 & 8

Student Name	Ethnicity	Final Grade	SATP Level
Student 1	AA	A	P
Student 2	AA	C	P
Student 3	C	A	A
Student 4	AA	A	P
Student 5	AA	B	P
Student 6	AA	A	A
Student 7	AA	C	P
Student 8	C	C	P
Student 9	AA	D	B*
Student 10	AA	B	P
Student 11	AA	D	B
Student 12	C	A	A
Student 13	C	A	A
Student 14	AA	A	A
Student 15	AA	B	P
Student 16	C	D	B
Student 17	AA	B	P
Student 18	C	B	P
Student 19	AA	D	P
Student 20	C	Dropped	N/A
Student 21	C	C	P
Student 22	C	B	A
Student 23	AA	B	P

Note. Ethnicity: AA=African-American, C=Caucasian, Final Grade: A=90-100 B=80-89, C=70-79, D=60-69, F=59 and below; SATP Level: A=Advanced, P=Proficient, B=Basic, M=Minimal,
* = Failed

Theme 4: Supportive Administrative Practices

The EST and chosen administrator identified some supportive administrative practices that were the key to the teacher's ability to be exemplary with her students. The theme identified focuses on the collective supportive administrative practices. However, within the discussion of the statements made by the exemplary teacher and the chosen administrator, it is apparent that the practices involved chosen administrator supporting the following: collaborative professional relationships; the use of evaluations as a non-intimidating, professional learning tool; a school culture and climate conducive to learning; and teacher autonomy.

Exemplary science teacher response. During the interview, the EST of students described administrative practices that supported her in a very positive way. The EST felt that she probably had a better administrator teacher relationship than most teachers because she had always had the support of both of her principals, causing her to experience continued growth as a teacher. The chosen administrator was a former coach at the high school; therefore, he had formed relationships with students and teachers prior to becoming the principal. This made it easier to approach the administrator. The EST never felt threatened by the chosen administrator's evaluations because he was always visible for both students and teachers. She deemed it as a necessary tool that the administrator had to use. She welcomed her administrator into her classroom anytime and would occasionally invite him to see certain student activities. Evaluations were another way for her to be measured and stay on her toes. The administrator never crowded out or micromanaged the teacher. However, the teacher felt that the administrator knew that she was self-motivated and did not need someone checking on her all the time to ensure that she was performing her job well. The chosen administrator was encouraging but gave constructive criticism and different ideas. The exemplary teacher stated,

> He allowed you to do what you thought was best for your kids. Having an administrator that has tunnel vision doesn't give you any room to try things. It's important to have an administrator that supports you with the resources that you feel you need for your class. (transcription p. 19, lines 513-515, 517-524)

The teacher named resources such as Brain-pop (interactive short video clippings and quizzes for science) and the test data system that is used from ELS as effective. The teacher explained that the administrator would meet with her and other teachers within the department to discuss resources, test data, and modifications if needed with their input. The teacher felt that it was important for teachers to have a voice in deciding factors for their students and classroom, and the chosen administrator understood that the teachers were just as much accountable for students' growth as he was for the school's growth. The administrator made her feel as though she was part of the decision-making process.

Chosen administrator response. During the interview, the chosen administrator described administrative practices that supported exemplary teachers in a very positive and supportive manner. The administrator felt that his primary goal was to provide an exemplary teacher with various support whether through resources of materials, finance, personnel, co-teaching, or co-planning. He felt that the overall structure of the school being safe and conducive for learning is another key component that he must provide. The administrator stated,

"It's not my job to tell them what to teach or how to teach but to be open and welcoming to new ideas and to support their new ideas and new activities from afar. I am hands-on through support" (transcription p. 22, lines 554-558).

He offered suggestions and allowed the teachers to have input in decision making that affected their instruction such as the timeline and the order of the curriculum. The administrator felt that his support is shown by giving the EST flexibility within the curriculum as long as the flexibility is research based, is effective, and comparable to their school demographics. He also said that it was important not to use evaluations as a means of 'I got you' but as an instrument of help to nurture teacher growth. He did not want evaluations to be a threat. The administrator felt that it was best to allow the teacher to self-observe via video or through the use of other teachers. The administrator never used intimidation or abuse of his power toward teachers or students. This was very much appreciated by the EST. He said it was important to trust the exemplary teacher's experience and knowledge in her field of expertise. He summed it up by saying that if we expect teachers to teach students, then we as administrators should teach teachers how to be effective. Trust teachers and allow/empower them to teach others because administrators do not have time to do it all.

Summary

This mixed methods study described how an EST and her selected supporting administrator rated the importance of particular elements of science instruction, described how she fostered success for students as she specified objectives, diagnosed and evaluated learners, planned, and delivered science instruction, and the described administrative practices that supported an exemplary high school science teacher. After review of the collected existing data for 2012 – 2013 school year regarding the research questions such as lesson plans, student test data from Biology I SATP and Biology I class grades, the EST and her chosen administrator was given a researcher-made questionnaire that was modeled after the STIN and converted into the QEST and QAPEST that focused on four elements of science instruction research questions. The participants were given wait time for member checking and triangulation of data. An interview was held with both participants. Interview responses were framed using the IPEST and IPAPEST.

From this data, the EST was found to be very successful in helping students to be successful in a school science program. Both participants believed that it was highly important for science teachers to be able to specify objectives, diagnose and evaluate learners, plan, and use multiple delivery techniques. The EST used various resources to help her specify science objectives. However, her primary source was the Mississippi Department of Education framework and then the blue print for the Biology I SATP. Both participants agreed that science teachers must know where they are going before they get there; therefore, assessment data and pretests are highly important in the planning process. Though there are multiple delivery techniques when teaching science, both participants believed that it is important for teachers to know, understand, and implement whichever delivery technique that the students need in order to be successful both in the class and on the state assessment because both are required for graduation.

Regardless of how well one may know the curriculum, both participants agreed that students do not care how much one knows until they know how much he or she cares. Relationships matter in the lives and success of students. If a teacher wants students to be successful, add a little tender-loving care to one's delivery techniques. Both participants believed that when a teacher gets involved in the students' world, they will become interested in the academic world.

CHAPTER V

THE SUMMARY, DISCUSSION, AND RECOMMENDATIONS

Introduction

Chapter V is divided into three sections: the summary, discussion, and recommendations. The discussion is framed and based upon the findings to the research questions. Recommendations include pragmatic suggestions from the researcher and suggestions for schools, administrators, science teachers and other stakeholders. A call for further research culminates the chapter.

The study described one EST and the administrative practices which support that teacher by measuring the success of students who were taught Biology I by the EST and took the Biology I SATP for the school year 2012 – 2013 at Langsdale High School. The theoretical framework for this study was primarily informed by the work of Rost (1991) in his foundational research documented in *Leadership for the Twenty-first Century*. In this present study, leadership is seen as an influence relationship that exists among leaders and collaborators who intend real changes that reflect the purposes mutually held by both the leader and collaborators. Rost (1991) claimed that leadership is not what leaders do but what leaders and collaborators do together. This definition of leadership leads to four essential elements that must be present in Rost's definition of leadership. The relations are based on influence from the leaders and followers in the relationship that intend real changes and that develop mutual purposes. The influence that a leader possesses is driven by the leader's credibility in the categories of character, care, courage, composure, and competence.

One purposeful, novel approach to this mixed-methods case study was the examination of student performance. Typically, student performance is a case study element given equal and perhaps even lesser weight when examining teacher practice depending on the philosophical slant of the researcher. However, herein, student performance is treated as a crucial element to this teacher's credibility as a professional. Students' success was based on their passing of the Biology I course according to the Langsdale School District grading policy while also scoring proficient or advanced on the Mississippi Department of Education's Biology I standardized exam typically given in the ninth or tenth grade of high school as a graduation requirement of the state's Subject Area Testing Program (SATP). The study followed a case study research design wherein the teacher and her chosen administrator were the case and the students' success was considered the translation of one crucially important condition of exemplary teaching for this case.

Both participants, the EST and her chosen administrator, completed a questionnaire that asked their perception of the importance of science instruction in the areas of specifying science objectives, diagnosing and evaluating learners, planning instruction, and the delivery of science instruction. These four areas are recorded in the STIN (Zurub & Rubba, 1983) instrument but reshaped into the primary questionnaire and interview protocol, called the QEST, QAPEST, *Interview Protocol of Exemplary Science Teachers* (IPEST), and the IPAPEST, as the primary data collection instruments for this study.

A plethora of existing data were examined to determine the validity of the EST's and the administrator's description of the teacher's use of the four areas of science instruction. Special care was taken to determine whether or not the EST's description of her teaching practice in these four areas could be corroborated 1) according to her ratings of importance of each and 2) according to her usage of them within the existing documents (lesson plans, test scores, and class grades). Participants were interviewed and member checks were conducted. Both the EST and administrator reviewed their own questionnaire and interview transcript.

The general findings of this study showed that students taught by this EST were successful in a science program, and the administrator supported this EST's practice. The more acute revelations in this study concerned the EST's and the administrator's beliefs that building a strong, personal, and professionally bounded relationship with students was powerfully influential in each students' plight for success. Lastly, the study showed that the EST and administrator shared the understanding of the importance of science instruction in a school.

Research Questions

There are three primary research questions that shaped the focus of this study.

Quantitative

1. How do an exemplary high school science teacher and her selected supporting administrator rate the importance of particular elements of science instruction?

Qualitative

2. How does an exemplary high school science teacher describe fostering success for

her students as she specifies objectives, diagnoses and evaluates learners, plans and delivers science instruction?

3. How are the administrative practices that support an exemplary high school science teacher described?

Summary

The EST and her chosen administrator were clearly knowledgeable about the four elements of a strong science instructional program. Prevalent in their deep, descriptive, and precise understanding of these four elements was their equally important understanding of the role of strong student-teacher relationship and the role of the teacher-principal relationship. Based upon the results of this research, pertinent discussion herein will respond to the research questions using under the headings found to be most pertinent themes in the data set. The themes identified are the following:

- Theme 1: Fostering Success through Elements of Science Instruction
- Theme 2: The Value of Relationships
- Theme 3: Evidence of Planning and Success
- Theme 4: Supportive Administrative Practices

The sections that follow discuss the literature related to Theme 1, Theme 2 and Theme 4. Theme 3 is not discussed in detailed as it was included in Chapter IV primarily as a source of documentation for the EST's success.

Theme 1: Fostering Success through Elements of Science Instruction

Data collected for the quantitative research question and first qualitative research question revealed how the two participants understood an exemplary instructional science program via the belief in the importance of four elements of EST practices of specifying objectives, diagnosing and evaluating learners, planning for science instruction, and delivering science instruction. The QEST and QAPEST data showed that both participants believed that all four areas of science instruction are ranked moderately to highly important for science teachers to be able to execute with precision. Each of the four areas revealed deep, thick, and rich description of what an exemplary teacher and her administrator were doing to help student be successful in this science program.

In answering questions to specifying objectives to interest students in science instruction, the teacher stated, "Objectives give both the teacher and student a clear direction of what knowledge they should gain." Objectives are posted daily on the teacher's board and written in "kid friendly" terms so that the students can easily understand them. The EST also wrote down a general overview of the day's lesson because she is not covering an entire state objective in one day. The teacher and administrator referred to objectives by using the Mississippi Department of Education framework as the primary source and a secondary resource such as practice SATP test booklets and the blueprint for the Biology I SATP that lists the number of questions for each objective that will be tested. In addition, the EST uses Langsdale district's science curriculum, program, and/or pacing guides that the administrator, the teacher of focus, and other science teachers in the Langsdale High School and other districts—a science objective checks and balances process widely believed to be exemplary. The curriculum is constantly evaluated in order to establish the best time line and sequence for the curriculum to establish a well-written pacing guide. The administrator and the teacher in this study described how the administrator provided common planning time and professional learning communities for the science department to work together in specifying objectives and establishing an appropriate science curriculum.

In answering questions about diagnosing and evaluating students in science instruction, the EST described diagnosing and evaluating learners by using assessment data from pre and post-tests to help correctly guide each individual student. Both the EST and administrator agreed, that formal and informal assessments could be simple pre-bell assignments or exit card assignments. Abell and Volkmann (2006) explained that assessment during instruction t should be seamlessness, meaning that instruction and assessment should flow naturally into each other from either direction. The information may be gathered from asking students questions, jotting down key concepts from the lesson, or drawing a picture to show their thinking. This is formative because the purpose is not to generate grades but to provide the teacher with information that will enable her to make adjustments to the instruction that reflects progress and needs of the students. The EST also used remediation or enrichment consistently to help dictate what she taught or remediated. This provided the teacher with clear direction. The teacher described how she used a specific scanning system, provided by the administrator. The EST told how this tool was integral in reading and identifying objectives to help her efficiently complete student data analysis, giving both the student and teacher evaluative feedback in a timely manner. The administrator professed that it was important for him to provide the EST with the resources, materials, or equipment she needed to help her quickly and effectively gather student data.

In answering questions to how the EST planned for science instruction, findings from the questionnaire and interview showed that the EST planned for science instruction by giving students pretests before every new objective to see where they are, where she needs to begin, and how she is going to get there. During the interviews, the teacher stated, “Planning serves as a roadmap for her science instruction.” The administrator stated, “Planning is like a blueprint.” The EST said that students must be involved in the process and learn how to read and interpret the data for their own use during remediation or enrichment. The administrator provided professional development time for the teacher to work within PLCs and with the leadership team to select appropriate commercially prepared instructional materials. The teacher emphasized the importance of carefully selecting instructional strategies and commercially prepared instructional materials to protect instructional time that may be wasted on inappropriate levels of materials. The teacher arrived before school and stayed after school to properly preparing for class and labs to minimize classroom distractions and to maintain students’ sense of security in her class.

The questionnaire and interview results indicated that the EST uses multiple delivery techniques during her science instruction. The EST explained “transitions” or mixes in her strategies between lecture, demonstration, inquiry, groups, and individualized strategies. The administrator described that the EST uses many “hands-on activities” to provide students with interactions and explorations. The EST claimed to use technology everyday as one of her primary delivery techniques. She spoke of technology in the form of a Power Point for interactive lecturing, showing a science clip or video, allowing the students to use the Promethean board or smart-board with click selectors during group work, playing electronic Jeopardy as a review, or using laptops to complete a virtual lab. The teacher described how she relied on and uses the students to facilitate the groups and the use of technology to increase student engagement and "sense of ownership" in the classroom.

Theme 2: The Value of Relationships

In this study, relationships seem to be of utmost importance for this EST in regard to her students and the chosen administrator. In this section, the relationships with students are the primary focus. The relationship with the administrator is discussed more under the heading of Theme 4.

The EST said, "It is our job as teachers to be the kind of people who motivate and ensure that students go to college or be better because they don't have anybody pushing them." All students "craved for attention". Both participants believe that having a professional relationship with students makes them want to succeed even more for the exemplary teacher. According to Rost (1991) collaborators or followers form relationships with leaders of their own choosing and not those who have authority over them. A true representation of postindustrial leadership involves leaders and collaborators interacting at all stages.

Ladson-Billings (1994) contended that teachers should cultivate relationships with students beyond the classroom because becoming involved with students outside of the classroom helps to remove or overcome artificial social barriers that exist. Further, Ladson-Billings (1994) suggested that teachers should be political beings and that students' lives or culture should be legitimized or made part of the curriculum. According to the teacher, "If students know you truly care about them, they're going to try to do more and they are going to respect you." Both participants attended students' games, told them how proud they were of any accomplishments, and sometimes attended their churches and other community events. The EST also made a "brag board" in her classroom displaying newspaper clippings, photographs, and other literature pertaining to students' success. In addition, the EST described the importance yet simple act of keeping an up-to-date display with the students' birthdays and gave them a gift of candy or a cupcake sticker with their names on it displayed on the board.

Cross (1993) suggested that it is not enough to be supportive of students and model nurturing…" (p.65). The EST related an analogy of students playing a football game to compare her true feelings about student-teacher relationships. You must "roar" or "stomp" in your own way to get results. You must also be a "cheerleader" on the field and off the field for your students. Meaning, in the classroom and in their everyday lives, a teacher must be involved if he or she wants to see great results. The teacher was successful at helping students become successful in a school science program. She yielded an overall success rate for students in her Biology I class and on the Biology I SATP (scored advanced or proficient) of seventy percent.

Theme 4: Supportive Administrative Practices

The second qualitative research was used to discover administrative practices that support the EST's practice. Data to answer this research question were collected through interviews with the EST and the chosen administrator.

According to Rost (1991), leadership consists of the following four essential elements if any relationship is to be considered as leadership: influence that is multidirectional, leaders and followers as the actors, leaders and followers that intent real change, and changes that intend reflect on their mutual purposes. The chosen administrator stated that his primary goal as an administrator is to give support in the area of “resources, flexibility, and trust.” Rost (1991) confirmed that the leader must be seen as credible amongst the followers by being trustworthy and concerned for others. The EST described the administrative practices during the interview as being supportive and the best she has ever experienced. She described the administrator as being trusting and approachable which made her comfortable going to him when she had a problem.

Rost (1991) also revealed that the leader must be seen as credible in the area of competence and courage. The EST explained that when the administrator gave constructive criticism, he offered suggestions and allowed the teacher to have input in decision making that affected her instruction. She gave examples of teacher input on decisions such as the instructional strategies, timeline, and the order of the curriculum. The last area of credibility shown by the administrator was his ability to keep his composure by having grace under pressure. According to the EST, the administrator “never” used intimidation or abuse of his power toward teachers or students. The administrator was characterized as one who empowered the teachers through flexibility and helped the teachers to understand that everyone has equal accountability in helping students to become successful. Additionally, the teacher reported about how the administrator relied on self-observations via video or peer observation as an element of growth for himself.

Rost and Smith (1992) revealed that leadership was no longer management but a relationship where leaders and followers have mutual purposes and intend real change. The administrator reported that he did not have to evaluate the EST in formal ways as often as he formally evaluated others because the EST "was always looking for ways to improve" when he observed her informally and discussed what he saw with her.

Both the EST and the administrator in this study seemed to have an unwavering trust which was characterized by non-uniform interactions which happened naturally throughout the school day, across the school year in a generative manner. This kind of non-methodical, informal support interaction between the teacher and administrator seemed to offer a more organic method for both educators and administrators to do their jobs. Each were professionalized further by the iterative, knowledgeable, and well-practiced mannerism which seemed not to follow any stereotypical, hovering administrator or unempowered teacher behavior.

Discussion

The primary lessons learned in this research had less to do with science instruction from an exemplary teacher and the administrator who supported her and more to do with the findings concerning culturally relevant teaching. The research questions of this study focused the data collection on aspects of science instruction which were embedded in the exemplary science teaching literature: 1) specifying science objectives, 2) diagnosing and evaluating learners 3) planning science instruction, and 4) delivering science instruction. Ultimately these research questions did not reveal much about the nature of science instruction. The final research question required an examination of the principal's support practices for the exemplary teacher and revealed lessons which were informed by Rost's one theory from *Leadership for the Twenty-first Century*. What these research questions as a whole and the surrounding data collection did reveal informs discourse on how one Caucasian exemplary science teacher instructing a high percentage of African-American students did and did not acknowledge her ethnicity, her students' ethnicity, or any interaction between hers and their ethnicity.

Exemplary Science Instruction Lessons Learned

Lastly, there was nothing that was profoundly unique which stood out in the EST's science instruction. The EST did as the researchers suggested about the four areas of science teaching in this study which included specifying objectives, diagnosing and evaluating learners, planning, and delivering science instruction. The EST consistently specified the appropriate objectives according to Chiappetta and Koballa (2010) by using the national, state, and local framework as a guide. The daily objectives could be seen in several locations in the classroom as well as outside in the hallway beside her classroom door with student work as examples from previous classes. The EST's behavior held true to the belief set forth by National Science Teacher Association (2012) that contextual changes are based on regional and cultural differences. The EST spoke very candidly about the objectives as she opened the lesson and related the objectives to students' everyday life whether sports, driving, working, technology, or using their family members as examples. The EST took advantage of every moment to reiterate the objective throughout the science lesson as she weaved into her conversation details from the students' lives and from teen culture. The EST also regularly used the students' questions about the lesson and used these questions to measure the relatedness of her daily lesson objectives to students' lives.

The EST viewed the diagnosing and evaluating of learners for science as an integral tool for future science success. The EST stood the test of Chiappetta and Koballa (2010) in regard to student achievement being measured through assessment, and no form of assessment was more important than the other. The use of assessments by the EST could be seen in many different forms. Students knew that every new objective came with a pretest and posttest. It was common to see the EST use formative assessments as evidence of learning that went beyond the call of memorization and regurgitation (NRC, 1996). The use of white boards to display understanding of the lesson individually or the use of electronic clickers were common daily engaging assessments. Classes never began without some form of opening assessment (bell ringer, vocabulary, picture, or video) and never ended without some form of closing assessment (exit ticket, white board, drawing, etc.). However, there was nothing more exciting to the students than everyday group work. The "thing of the day" for the EST to use as a way of assessment was the promeathan board activities that included several brain pop lessons/quizzes. This form of technology kept the students fully engaged and monitored their progress. It was most satisfying to the EST for all students to be able to read and interpret their own test data. The EST strived for her instruction and assessment to flow easily so that the students did not fear learning but understood that assessments were necessary to help prepare them for what is to come (Abell & Volkmann, 2006). The many different forms of assessments used by the EST were not solely for the purpose of grading but mostly to assist in the focus of growth and science achievement of her students. The planning done by the EST for her science instruction stood out to be among the best. The process of planning that was displayed by the EST mirrored the research of Chiappetta and Koballa (2010) and

Rosenshire (2002). This aspect of science instruction was the most important to the EST. The EST expressed over and over how planning was the centerpiece for all that she did within her science instruction. The EST planned at least two or three weeks ahead by using the state science framework, any previously taken assessment data, and departmental expectations. The EST was very committed to being prepared, even if it required her to stay at the school late into the evening or arrive at school early before school began each day. In the EST's planning, she was most focused on the whom, what, and how of the science teaching. This gave the EST a sense of direction so that she knew where she was going and how she was going to get there. Therefore, the EST always used two or more instructional strategies. The EST could be seen lecturing, discussing, or demonstrating within one class period. However, she expressed the importance of laboratory to bring life to the science instruction. Within the EST's planning, it was visibly clear that a positive learning environment must be created. Sometimes groups were chosen by the teacher while students were given liberty of choice on other things. Safety and a sense of belonging within the EST's science classroom was an important factor in her science instruction planning. Regardless of the instructional strategies, the EST's delivery technique was used to enhance every aspect of the instruction so that the students benefited academically. The EST's lecturing was interesting for students as demonstrated by their eye contact, responses to her questions, conversations with peers, and even in the smiles and laughter at her humor. The demonstrations presented key aspects of the science content to the students during which questions were readily posed, investigations were naturally conducted, and data was routinely gathered to explain phenomena. Inquiry science activities filled the atmosphere.

Leadership Lessons Learned

Perhaps she was emulating Rosts's ideas about leadership which seem to be void of recognition of ethnicity and culture instead of emulating the teachers in GLB's work who claimed that recognition of ethnicity and culture were essential to being exemplary.

The Rost (1991) theory holds true in this study when the relation between the administrator and teacher is influenced by mutual respect. Both participants visibly acknowledged each other's role and mirrored respect in front of the students and other teachers in the school in a natural manner. The regular practice of the administrator allowing the exemplary teacher to oversee and make changes in the science department in the areas of specifying objectives, diagnosing and evaluating learners, planning science instruction, and delivering science instruction put the 4 things which were part of your research questions in this sequence) without administrative supervision showed great leadership credibility, as Rost defines it, on behalf of both the exemplary science teacher and administrator. The relationship between adults, when visible to students, is rooted in Rost's theory of a leader and a follower changing roles easily and respectfully in natural ways to accomplish goals. Typically, teacher and principal roles are considered static. There are clear boundaries that distinguish the teacher from the administrator. However, according to Rosts's theory, the roles change. The EST was unannounced and unofficially viewed as an authority or status figure by students and teachers not only in the science department but throughout the school. Her credibility and relation with the administrator and students profoundly spoke and defined her among all those she encountered and was spread far more than she seemed to know or to profess during the interview.

Lessons Learned About Ethnicity, Culture, and Other Characteristics

The Langsdale EST participant in this study was not aware of her students' issues of culture or ethnicity. If she was aware of her students' particular cultural needs, she was not willing to admit this notion to the researcher. Primarily, only two ethnicities were present in the district, school, and science classroom of the Langsdale EST—African-American and Caucasian. In fact, only two high schools are present in this rural county where the Langdale case is located. Of these two, Langsdale is commonly considered the African-American school and district in the county and the neighboring district within the same county is commonly considered the Caucasian district and houses the high school commonly referred to as the Caucasian high school. The demographic characteristics of the students taught by the EST became clear during the analysis of this case study, but the teacher did not seem to see this demographic characteristic as important or as having any bearing on her exemplary science teaching practices. Though the researcher pressed the EST on the particular needs of the African-American students in her class and how these students had been successful for her and not for other science teachers, the EST would not acknowledge ethnicity. She seemed to confirm that ethnicity of students was not a concern. Possibly, the teacher would not acknowledge ethnicity because the researcher is African-American. Further probing in this area is necessary.

With respect to the theory which informs this research project, the work of Gloria Ladson Billings in her foundational work The Dream Keepers: Successful Teachers of African-American Children (2009), provides some commentary about the teacher and principal participants' instructional practices, though not specifically in science instruction. The teacher is Caucasian. The African-American principal acknowledges that some Caucasian teachers who teach mostly African-American students do not know how to relate to the particular culture of their students. He does not believe that the lack of exemplary teaching is due totally to the mismatch in ethnicity or culture between the teacher and student, however. He did profess to believe that this mismatch can play a major role in the success of African-American students when they are taught by Caucasian teachers.

The EST on which this study is focused was believed by this administrator to have a unique relationship with her African-American science students. The principal described a unique relationship experienced between the EST of focus and her students. He noted that she struggled to recognize ethnicity as an issue interfering with her instruction in any way. In fact, she would not acknowledge their African-American ethnicity, culture or race as a particular characteristic. Rather, her connection to students was highly individual. She noted demographic characteristics like level of income or family structure of single parent homes as potential barriers to her students. She noted these conditions as threats to her ability to reach her students with the most exemplary teaching possible. She did not claim that these conditions caused her any benefit nor deficiency in teaching though low income and single parent criteria started students with a deficit toward any academic content including science.

Recommendations for Future Research

The findings from this study have implications for schools desiring to identify the ways that exemplary teachers foster success and maintain positive student –teacher relationships. The findings also have implications regarding the importance of leadership support to the practices of an exemplary teacher. Also, the findings from this study show that leaders and followers may change roles at any time.

The findings also have implications related to the leadership implemented by a school administrator Following Rost's (1991) theory, the administrator exhibited great credibility by being competent, trusting, and caring while having the courage to stand up for his beliefs; yet, being willing to change and maintain his composure while under pressure. This gave merit to the administrator being a credible leader that builds and encourages positive student-teacher relationship as a strong characteristic that encourages both teachers and students to work hard and succeed based upon the influence of the relationship where leaders and followers interact at all stages of postindustrial leadership (Rost, 1991).

This mixed methods study had limitations, and there are several recommendations for future research that address those methodological limitations. While the researcher employed procedures to reduce limitations, the study could be repeated with additional measures to reduce limitations further. The following recommendations are suggested for future studies:

1. It is recommended that similar research be conducted using schools that are racially, socio-economically, and academically equivalent to Langsdale High School. This study was centered in only one geographical area. This study was conducted at a high school in a rural community that is not racially, socioeconomically, or academically equivalent to the surrounding schools. While the findings cannot be generalized due to the small sample size, the

findings could potentially be applied only to the instructional settings that serve.

2. It is recommended that future studies be conducted using a larger, randomly selected sample. Because there were only two participants in this study, the findings cannot be generalized. In addition, the participants were selected purposefully and not randomly. This method of participant selection also impacts the generalizability of a study.
3. It is recommended that future studies be conducted with stronger definition of "success". The study was limited in its classification on the measurement of success by the researcher. Specifically, success was determined based on students' course grades and passing score on the state-mandated Biology I exam. Researchers have argued that course grades are subjective and, therefore, not a good determination of success (Allen & Lambating, 2001; Marzano, 2000; Thorndike, 1997). For this reason, additional research is recommended with more expansive and research-based definitions of success.
4. It is recommended that future studies be conducted using a more recently developed instrument. Though tested for validity, the age of the instrument and the quality of the questions could be misleading or misinterpreted. For this reason, additional research is recommended with an instrument that was developed within the 21st Century.

In light of the aforementioned methodological limitations, recommendations for future research have the potential to add more information to the literature regarding the practices of ESTs and the administrators who support them.

There are other recommendations for future research not based on the methodological challenges. These recommendations are based on the areas of research that were prompted by the findings from this study. Beyond the scope of this dissertation, there exists more work. These recommendations are listed below.

1. It is recommended that future research be conducted on the strategies used by science teachers stay abreast with the fast-changing science curriculum.
2. It is recommended that future research be conducted to help provide teachers with effective teaching strategies for students. There is limited research on science teacher practices in science instruction.
3. It is recommended that future research be conducted on ways to foster student-educator relationships and the impact of those relationships on the academic achievement of students in science.
4. It is recommended that future research be conducted to address exemplary science practices used with African-American students. Although these participants did not provide any statements specific to the success of African-American students, it was noted in the course grades and Biology I SATP data that African-American students were successful in the EST's class with an overall success rate of 69%.

The EST's success with African-American students aligns with Ladson-Billing's (1994, 2009) concept of culturally relevant teaching. Ladson-Billings (1994) designated eight successful teachers of African-American students as "dreamkeepers". In this study, assessment and course performance were treated as a main characteristic of being an exemplary teacher. With a primary focus on assessment and course results in a Biology I course for this teacher, results still yielded that the teacher's characteristics and even the administrator's characteristics were consistently aligned with "successful" teachers' characteristics in Ladson-Billings' (1994) work.

Ladson-Billings (1994, 2009) stated that in order for a teacher to be successful in teaching African-American students, the teacher must have high expectations for all students and create classroom climates that foster and encourage student success by getting students to 'choose' academic excellence. The teacher must build a community in her classroom between and among students to allow students to feel safe. There must be a connection with students and families on a personal level so that each child's interests can be used in the classroom. Lastly, because students do not begin on the same playing fields, the teacher must make connections between the curriculum and students' lives so that each student feels personally invested, interested, and connected to the curriculum. Both the teacher and the administrator in this study prioritized the educator traits Ladson-Billings reveals in her text specifically aimed at success with African-American learners.

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APPENDIX A

PARTICIPANT RECRUITMENT LETTER AND IRB APPROVAL

Recruitment Letter for Potential Participants

Dear Teacher,

My name is Minnie Dace, and I am a doctoral student in the College of Education at Mississippi State University. I am in the process of completing my dissertation. My research is titled, "Describing One Exemplary Science Teacher of African American Students and the Administrative Practices Which Support that Teacher." For this study, I will be using a questionnaire to collect data from one exemplary science teacher of African American Students and this teacher's chosen administrator who the teacher feels has shown/given him/her support. After the questionnaire data collection is gathered and after a brief waiting period has passed, I will follow-up with the same teacher and the same chosen administrator to conduct an interview with each. The teacher, the principal, the school, the district, and any other identifying information will be represented by pseudonym in the study.

In addition to the questionnaire and the interview data, I will also be gathering multiple existing data sources from 2012–2013 such as Biology I test data, Biology I class grades, teacher evaluations, classroom observation reports, lesson plans, questionnaires, protocols, professional development materials, samples of student work, etc. Existing data will be delinked from student, teacher, or administrator name and/or any identifying information.

I aim to describe what one exemplary science teacher of African American Students is doing to help students be successful in a school science program and what administrative practices support that teacher. A review of the literature prompted the formation of the following secondary research questions to assist in gathering data to answer the primary research question:

1. How is one exemplary science teacher in this district able to specify objectives to interest African American students in science instruction in her classroom teaching?
2. How is one exemplary science teacher in this district able to diagnose and evaluate African American students in science instruction in her science classroom?
3. How is one exemplary science teacher in this district planning to interest African American students in science instruction?
4. How is one exemplary science teacher in this district delivering science instruction to interest African American students in her science classroom?
5. How are the administrative practices—which support or detract—described by this one exemplary science teacher of African American students?
6. How are the administrative practices—which support or detract—described by the particular administrator chosen by this one exemplary science teacher of African American students?

Completion of the questionnaire is estimated to take no longer than 30 minutes and the interviews will take approximately 45 minutes to complete. Questionnaires and interviews will take place at a time and location that is convenient for the participants in this study. Interviews will be transcribed in order to analyze data most accurately.

As an extra protection for participants in this study, I am asking for each to sign a consent form which shows I have your permission for you to participate in the study. In your envelope you will find two consent forms and the Questionnaire of Exemplary Science Teachers (QEST). If you agree to participate in the study, please do the following: 1) sign both the yellow and the white informed consent form, 2) complete the questionnaire, 3) keep the white copy for your records, and 4) return the yellow copy of the consent form and the questionnaire to me when I call for the documents to be submitted.

Participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty or loss of benefits to which you are otherwise entitled. The data and results of the research will remain anonymous. If you have any questions concerning this research study, please contact me at (601)-274-0341 or via email at mlm91@msstate.edu. You may also contact Dr. Kay Brocato, my dissertation advisor, at (662)-325-7060 or via email at kbrocato@colled.msstate.edu. You may also contact the Institutional Review Board which is in charge of protecting human subjects for MSU at their office at (662)-325-3294 or via email at irb@research.msstate.edu.

Thank you for your consideration,

Minnie Dace
Doctoral Student, Mississippi State University

MSU HRPP	Approved: 06/20/2016	Expires: 08/31/2017
	IRB # 16-107	

APPENDIX B

INFORMED CONSENT

District Consent Letter

I freely, voluntarily, and without element of force or coercion, consent for the researcher in the research project entitled "The Importance of Science Instruction: A Case Study of Exemplary Teaching and Administrative Support" to collect and use Langsdale School District student and teacher data.

This research is being conducted by Minnie Dace, who is a doctoral student at Mississippi State University. I understand the purpose of the research is to examine the attitudes of an exemplary high school science teacher and her selected leading administrator on the importance of science instruction; to determine how an EST fosters success for her students; and to identify the administrative practices that supported the exemplary high school science teacher as she fostered success for her students.

I understand that all collected data will be kept confidential and identified by a code. None of the individual's name will appear on any of the results.

I understand there is no risk involved if I agree to the use of the data in this study. This consent may be withdrawn at any time without prejudice, penalty, or loss of benefits to which I am otherwise entitled. I have been given the right to ask and have answered any inquiry concerning the study.

I understand that I may contact Minnie Dace at 1580 Shubuta Eucutta Rd, Shubuta, MS, by phone at 601-274-0341 or via e-mail at mlm91@msstate.edu, for any questions that I may have in regards to this research or my rights. Results of the study may be sent to me upon my request.

I have read and understood this consent form.

___________________________________ ____________________

(Subject) (Date)

____

(Witness)

APPENDIX C

COVER LETTER TO INTERVIEW QUESTIONNAIRE

Cover Letter to Interview Questionnaire

Dear Educator,

I am conducting an interview to describe an exemplary science teacher of African-American students and the administrative practices which support that teacher in science using the questions from the Science Teachers Inventory of Need as a model.

Science teachers' voices should play a vital role in the decisions that are made toward improving science. As a valuable member of the science department within your school district, your participation is extremely important.

I would greatly appreciate if you would take the time to complete a forty-five minute interview with me at a time that is convenient for you. The interview will be held in your classroom after school hours and behind closed doors so that you will feel comfortable at the time of the interview. Your participation will be completely confidential. Your name and all other identifying information will not be listed on the project. The results will only be used for the purpose of my research.

Sincerely,

Minnie Dace
PhD Student

APPENDIX D

QUESTIONNAIRE OF EXEMPLARY SCIENCE TEACHERS

Questionnaire of Exemplary Science Teachers (QEST)

The *Questionnaire of Exemplary Science Teachers* (QEST) was developed from the *Science Teacher Inventory of Need* (STIN) which assesses science teachers' perceptions of their professional needs and modified to assess science teachers' perceptions of their professional importance. The QEST contains 27 items grouped under four instruction related categories: specifying objectives for science instruction, diagnosing and evaluating learners for science instruction, planning science instruction, and delivering science instruction. Each item is composed of a question, a coded scale, and a blank. The question portion of an item asks a task a science teacher may have to perform. Following the question is the coded scale "NF 1 2 3 4" where:

NF = Not familiar with task
1 = Not Important
2 = Minimally Important
3 = Moderately Important
4 = Highly Important

In responding to an item you are asked to do the following:

1. Circle the one code that best designates the degree to which you deem the importance for effective science instruction.
2. If you wish, detail the nature of your importance by listing specific topics in the blank.

Please respond to each of the items on the following pages. You may mark your responses in this packet.

Questionnaire of Exemplary Science Teachers (QEST)

NF = Not familiar with task
1 = Not Important
2 = Minimally Important
3 = Moderately Important
4 = Highly Important

A. How important is it for science teachers in this district to be able to specify objectives for science instruction in their classroom teaching?(How important is it for you to be able to specify objectives for science instruction in your classroom teaching?)

1. How important is it for science to be taught in school?
   ____ NF 1 2 3 4

2. How important is it to have an established science curriculum/program?
   ____ NF 1 2 3 4

3. How important is the content in a previous (5^{th}, 8^{th}, Biology I) science course?
   ____ NF 1 2 3 4

4. How important is it for you to have objectives for science knowledge, attitudes, and skills for students to develop scientists?
   ____ NF 1 2 3 4

5. Givie an example of at least one knowledge, one attitude, and one skills objective.

   ____

6. How important is it to have science objectives arranged in the sequence they will be addressed in your lessons?
   ____ NF 1 2 3 4

7. Is there anything else you want me to know about science objectives?

B. How important is it for science teachers in this district to be able to diagnose and evaluate learners for science instruction in their science classrooms? (How important is it for you to diagnose and evaluate learners' science needs in your classroom?)

1. How important is it for you to design assessment items/procedures that validly assess science instruction?
   ______________________________________ NF 1 2 3 4

2. How important is it for you to use assessment data to determine students' readiness or difficulties in your classroom?
   ______________________________________ NF 1 2 3 4

C. How important is it for the science teachers in this district to plan science instruction?

1. How important is it for you to use student-readiness data to plan for science instruction?
   ______________________________________ NF 1 2 3 4

2. How important is it for you to develop an instructional plan for science instruction?
   ______________________________________ NF 1 2 3 4

   - For a single session NF 1 2 3 4
   - Selection of instructional strategies NF 1 2 3 4
   - Selection of commercially prepared instructional materials NF 1 2 3 4
   - Preparation of teacher-made instructional materials NF 1 2 3 4
   - Arrangement of the class/lab, etc. NF 1 2 3 4

D. How important is it for the science teachers in this district to deliver science instruction?

1. How important is it for you to motivate students to learn science?
   ______________________________________ NF 1 2 3 4

2. How important is it for you to use the following science-instruction delivery techniques?
   ______________________________________ NF 1 2 3 4

   - Inquiry teaching strategy NF 1 2 3 4
   - Laboratory NF 1 2 3 4

- Lecture/illustrated talk NF 1 2 3 4

3. How important is the demonstration of concept, process skill, or manipulative skill (give example of each)?
   ____ NF 1 2 3 4

   - Field trip
     ____ NF 1 2 3 4
   - Simulation technique
     ____ NF 1 2 3 4
   - Team teaching
     ____ NF 1 2 3 4
   - Value clarification strategy
     ____ NF 1 2 3 4
   - Individualized instruction
     ____ NF 1 2 3 4
   - Group/panel discussion
     ____ NF 1 2 3 4
   - Peer tutoring
     ____ NF 1 2 3 4

4. How important is it for you to use audiovisual equipment, computers, and/or the library/media center in delivering science instruction?
   ____ NF 1 2 3 4

APPENDIX E

INTERVIEW PROTOCOL OF EXEMPLARY SCIENCE TEACHERS

Interview Protocol of Exemplary Science Teachers (IPEST)

A. How important is it for science teachers in this district to be able to specify objectives for science instruction in their classroom teaching?(How important is it for you to be able to specify objectives for science instruction in your classroom teaching?)

1. Why should science be taught in school?
2. How necessary is it to have an established science curriculum/program?
3. What content is needed in a (5th, 8th, Biology I) science course?
4. How necessary is it for you to have objectives for science knowledge, attitudes, and skills for students to develop as scientists? Give an example of at least one knowledge, one attitude, and one skills objective.
5. How important is it to have science objectives arranged in the sequence they will be addressed in your lessons?
6. Is there anything else you want me to know about science objectives?

B. How important is it for science teachers in this district to be able to diagnose and evaluate learners for science instruction in their science classrooms? (How important is it for you to diagnose and evaluate learners' science needs in your classroom?)

1. Do you design assessment items/procedures that validly assess science instruction? How so? Can you give an example?
2. How do you use assessment data to determine students' readiness or difficulties in your classroom?

C. How important is it for the science teachers in this district to plan science instruction?

1. How do you use student-readiness data to plan for science instruction?
2. How do you develop an instructional plan for science instruction?
    - For a single session
    - Selection of instructional strategies
    - Selection of commercially prepared instructional materials
    - Preparation of teacher-made instructional materials
    - Arrangement of the class/lab, etc.

D. How important is it for the science teachers in this district to deliver science instruction?

1. How do you motivate students to learn science?
2. How often do you use the following science-instruction delivery techniques?
    - Inquiry teaching strategy

- Laboratory
- Lecture/illustrated talk

3. How important is the demonstration of concept, process skill, or manipulative skill (give example of each)?
    - Field trip
    - Simulation technique
    - Team teaching
    - Value clarification strategy
    - Individualized instruction
    - Group/panel discussion
    - Peer tutoring

4. How often do you use audiovisual equipment, computers, and/or the library/media center in delivering science instruction?

APPENDIX F

QUESTIONNAIRE FOR ADMINISTRATOR PERCEPTION OF EXEMPLARY SCIENCE TEACHERS (QAPEST)

Questionnaire for Administrator Perception of Exemplary Science Teachers

(QAPEST)

The *Questionnaire for Administrator Perception of Exemplary Science Teachers* **(**QEST) was developed from the *Science Teacher Inventory of Need* (STIN) which assesses science teachers' perceptions of their professional needs and modified to assess administrator's perceptions of science teachers professional importance. The QEST contains 27 items grouped under four instruction related categories: specifying objectives for science instruction, diagnosing and evaluating learners for science instruction, planning science instruction, and delivering science instruction. Each item is composed of a question, a coded scale, and a blank. The question portion of an item asks a task a science teacher may have to perform. Following the question is the coded scale "NF 1 2 3 4" where:

NF = Not familiar with task
1 = Not Important
2 = Minimally Important
3 = Moderately Important
4 = Highly Important

In responding to an item you are asked to do the following:

1. Circle the one code that best designates the degree to which you deem the importance for effective science instruction.
2. If you wish, detail the nature of your importance by listing specific topics in the blank.

Please respond to each of the items on the following pages. You may mark your responses in this packet.

Questionnaire for Administrator Perception of Exemplary Science Teachers

(QAPEST)

NF = Not familiar with task
1 = Not Important
2 = Minimally Important
3 = Moderately Important
4 = Highly Important

A. **How important is it for science teachers in this district to be able to specify objectives for science instruction in their classroom teaching?**

1. How important is it for science to be taught in school?
   ____ NF 1 2 3 4

2. How important is it to have an established science curriculum/program?
   ____ NF 1 2 3 4

3. How important is the content in a previous (5^{th}, 8^{th}, Biology I) science course?
   ____ NF 1 2 3 4

4. How important is it for science teachers to have objectives for science knowledge, attitudes, and skills for students to develop scientists?
   ____ NF 1 2 3 4

5. Givie an example of at least one knowledge, one attitude, and one skills objective.

   ____

6. How important is it to have science objectives arranged in the sequence they will be addressed in science teachers' lessons?
   ____ NF 1 2 3 4

7. Is there anything else you want me to know about science objectives?

B. How important is it for science teachers in this district to be able to diagnose and evaluate learners for science instruction in their science classrooms?

1. How important is it for science teachers to design assessment items/procedures that validly assess science instruction?
   ____ NF 1 2 3 4

2. How important is it for science teachers to use assessment data to determine students' readiness or difficulties in their classrooms?
   ____ NF 1 2 3 4

C. How important is it for the science teachers in this district to plan science instruction?

1. How important is it for science teachers to use student-readiness data to plan for science instruction?
   ____ NF 1 2 3 4

2. How important is it for science teachers to develop an instructional plan for science instruction?
   ____ NF 1 2 3 4

   - For a single session NF 1 2 3 4
   - Selection of instructional strategies NF 1 2 3 4
   - Selection of commercially prepared instructional materials NF 1 2 3 4
   - Preparation of teacher-made instructional materials NF 1 2 3 4
   - Arrangement of the class/lab, etc. NF 1 2 3 4

D. How important is it for the science teachers in this district to deliver science instruction?

1. How important is it for science teachers to motivate students to learn science?
   ____ NF 1 2 3 4

2. How important is it for science teachers to use the following science-instruction delivery techniques?
   ____ NF 1 2 3 4

   a. Inquiry teaching strategy NF 1 2 3 4
   b. Laboratory NF 1 2 3 4
   c. Lecture/illustrated talk NF 1 2 3 4

3. How important is the demonstration of concept, process skill, or manipulative skill (give example of each)?
   ______________________________________ NF 1 2 3 4

   a. Field trip
      ______________________________________ NF 1 2 3 4

   b. Simulation technique
      ______________________________________ NF 1 2 3 4

   c. Team teaching
      ______________________________________ NF 1 2 3 4

   d. Value clarification strategy
      ______________________________________ NF 1 2 3 4

   e. Individualized instruction
      ______________________________________ NF 1 2 3 4

   f. Group/panel discussion
      ______________________________________ NF 1 2 3 4

   g. Peer tutoring
      ______________________________________ NF 1 2 3 4

4. How important is it for science teachers to use audiovisual equipment, computers, and/or the library/media center in delivering science instruction?
   ______________________________________ NF 1 2 3 4

APPENDIX G

INTERVIEW PROTOCOL FOR ADMINISTRATOR PERCEPTIONS OF

EXEMPLARY SCIENCE TEACHERS

Interview Protocol for Administrator Perceptions of Exemplary Science Teachers

(IPAPEST)

A. How are administrators in this district able to help science teachers specify objectives for science instruction in their classroom teaching?(How are you able to specify objectives for science instruction in your school?)

1. Why should science be taught in school?
2. How necessary is it to have an established science curriculum/program?
3. What content is needed in a (5th, 8th, Biology I) science course?
4. How necessary is it for you to have objectives for science knowledge, attitudes, and skills for students to develop as scientists? Give an example of at least one knowledge, one attitude, and one skills objective.
5. How important is it to have science objectives arranged in the sequence they will be addressed in your lessons?
6. Is there anything else you want me to know about science objectives?

B. How are administrators in this district able to help science teachers diagnose and evaluate learners for science instruction in their science classrooms? (How do you diagnose and evaluate learners' science needs in your school?)

1. Do you design assessment items/procedures that validly assess science instruction? How so? Can you give an example?
2. How do you use assessment data to determine students' readiness or difficulties in your school?

C. How are administrators in this district able to help science teachers with planning science instruction?

1. How do you use student-readiness data to plan for science instruction?
2. How do you develop an instructional plan for science instruction?
    - For a single session
    - Selection of instructional strategies
    - Selection of commercially prepared instructional materials
    - Preparation of teacher-made instructional materials
    - Arrangement of the class/lab, etc.

D. How are administrators in this district able to help science teachers with delivering science instruction?

1. How do you motivate students to learn science?

2. How often should a science teacher use the following science instruction delivery techniques?

    - Inquiry teaching strategy
    - Laboratory
    - Lecture/illustrated talk
    - Demonstration of concept, process skill, or manipulative skill (give example of each)
    - Field trip
    - Simulation technique
    - Team teaching
    - Value clarification strategy
    - Individualized instruction
    - Group/panel discussion
    - Peer tutoring

3. How often should a science teacher use audiovisual equipment, computers, and/or the library/media center in delivering science instruction?

APPENDIX H

EXEMPLARY SCIENCE TEACHER LESSON PLAN—HIGH STATUS

Ownership (Group Edit)

No Group Edit/Ownership

Title:

Week of August 13, 2012

Subject: Biology I

Start Date:

08/10/2012

End Date:

08/10/2012

Show Only Standards for:

Not Specified

Covered Standards:

Use Ctrl/Cmd + Click to select multiple standards from list

[BI.1.1] Apply inquiry-based and problem-solving processes and skills to scientific investigations.

[BI.1.a.] Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)

[BI.1.a.1] Safety rules and symbols

[BI.1.a.2] Proper use and care of the compound light microscope, slides, chemicals, etc.

[BI.1.a.3] Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers

[BI.1.b.] Formulate questions that can be answered through research and experimental design. (DOK 3)

[BI.1.c.] Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, d

[BI.1.d.] Construct and analyze graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)

[BI.1.e.] Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)

[BI.1.f.] Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)

[BI.1.g.] Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)

PRIVATE PLAN DETAILS

Lesson Line	Time	Day / Date: Monday August, 13, 2012
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem #1 Unit 1 from MS Biology Test Prep book. TLW analyze the bellringer and submit their answer in written form using prior knowledge. TTW discuss the possible choices and discuss with TL why an option is or is not the correct answer.
Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display the vocabulary words biology, organism, organization, growth and development and ask TL what they think each word means. TLW complete a 4 square graphic organizer for each term to include word, definition in their own words, picture representing the word and a real-world example or analogy to better understand meaning of the term. TTW call on students to share and explain their graphic organizers with the class. TTW discuss prefixes such a bio (previously introduced) and it's literal meaning.
Hook/Set (Focus student attention)		TTW will ask students what characteristics they have observed that are shared by all living things and record them on the board. Who do you think decided what is living and what is nonliving? How do you think they determined the classifications of living and nonliving? TLW respond verbally to teacher questions. TTW explain that biology is the study of living things and that all living things have 8 major characteristics in common and that biologists are scientists that study these characteristics by making observations and biology is the science of living things.
Modeling (Teaching of Lesson)		TTW display the interactive powerpoint presentation "Introduction to Biology" and discuss what biologists do as well as the characteristics of life. TTW randomly call on students throughout the presentation to check for understanding.
Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		TTW hand out and display the activity "The Martian and the Car" and randomly select a student to read the passage aloud. TLW develop one argument for the prosecution and one from the defense attorney using the characteristics of life discussed throughout the lesson. TTW randomly call one two students to give their argument or either the prosecution or the defense attorney.

Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**	TLW work in pairs to complete the arguments for both the defense attorney and the prosecutor to determine if Marty indeed brought home a living organism from the planet Earth.	
Closure		TTW randomly call on students to give arguments for both the prosecution and the defense attorney and have them explain which characteristic of life it supports or does not support.
Accommodations		Accomodations from IEPs will be included once they have been provided.

Lesson Line	Time	Day / Date: Tuesday August, 14, 2012
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem #2 Unit 1 from MS Biology Test Prep book. TLW analyze the bellringer and submit their answer in written form using prior knowledge. TTW discuss the possible choices and discuss with TL why an option is or is not the correct answer.
Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display the vocabulary words biology, organism, organization, growth and development and ask TL what they think each word means. TLW complete the vocabulary portion of their science notebook activity where they use the words in contextual format. Vocabulary: homeostasis, organism, organization, reproduction, response, species, stimulus. Review vocabulary word: Environment TTW call on students to share and explain their answers with the class.
Hook/Set (Focus student attention)		TTW will hold up various items and have students consider whether each item is living, nonliving, or dead. TLW verbally explain what helped them determine whether the answer was living.
Modeling (Teaching of Lesson)		TTW display the interactive powerpoint presentation "Introduction to Biology" and discuss what biologists do as well as the characteristics of life. TTW randomly call on students throughout the presentation to check for understanding.

Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		TLW complete sections of their science interactive notebook throughout the lesson (ex. TTW teach a portion of the information and the student will examine the textbook for that section to answer the questions in their notebook incorporating common core principals). TTW discuss the science notebook sections with the class by randomly calling on students to check for answers. TLW play a game of homeostasis charades. One student will act out a way an organism's homeostasis can be disrupted and ask the class to guess which condition is being acted out and how the body can maintain homeostasis when this occurs.
Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**	TLW work in pairs to complete mini lab 1.1. In this lab, they will observe objects to determine if they are living or dead by creating a four column data table. TL must list the object, make their prediction, discuss the characteristics of life and provide evidence of the object being living or nonliving based on those characteristics.	
Closure		TTW ask students to summarize the eight characteristics of life verbally by calling on random students.
Accommodations		Accomodations from IEPs will be included once they have been provided. SD (have not received IEP)
Lesson Line	**Time**	**Day / Date:** Wednesday August 15 , 2012
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem #3 Unit 1 from MS Biology Test Prep book. TLW analyze the bellringer and submit their answer in written form using prior knowledge. TTW discuss the possible choices and discuss with TL why an option is or is not the correct answer.

Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display the vocabulary words science, theory, peer review, metric system, SI, forensics, ethics , investigation and ask TL what they think each word means. TLW complete the vocabulary portion of their science notebook activity where they use the words in contextual format. Review vocabulary word: investigation TTW call on students to share and explain their answers with the class.
Hook/Set (Focus student attention)		TTW explain to students that science is based on inquiry that seeks to develop explanations. For example, if you see a headline that reads "Alien baby found in campsite," how do you know whether you should believe it or not? How do you know when to trust claims made in advertisement on television (give examples) or the internet, or in a newspaper or magazine? What makes something science based? TTW ask students what are some example of testable questions. What are some examples of questions that are not testable. TLW respond verbally to teacher's questions. TTW ask students if they have ever read a horoscope in the newspaper, magazine or online? How was it determined? Was it based on sound scientific methods?
Modeling (Teaching of Lesson)		TTW display the interactive powerpoint presentation "The Nature of Science" and discuss the characteristics of science as well as pseudoscience. TTW randomly call on students throughout the presentation to check for understanding.

Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		TLW complete sections of their science interactive notebook throughout the lesson (ex. TTW teach a portion of the information and the student will examine the textbook for that section to answer the questions in their notebook incorporating common core principals). TTW discuss the science notebook sections with the class by randomly calling on students to check for answers. TLW read aloud the portion of the text sections titled "Expands scientific knowledge" and "Challenges accepted theories" (one paragraph each) and TTW help students internalize the process of comprehension by stressing the meaning of these two sections by talking through difficult words, breaking apart the sentences to obtain meaning and to connect what they are reading to prior knowledge or experiences. TLW observe and analyze figure 1.12 and make inferences about the bird, bat and human bones (they should see that a bat has bones more closely related to human bones than bird bones). TTW explain skepticism and that scientist are skeptics. TTW ask the students if skepticism is a neutral or a negative position (they will get to be skeptics in part of the independent practice).
Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**	TLW complete the activity "Debunking Astrology." In this activity, students will be given several horoscopes and asked to read them and decide which one relates the most to them. TLW complete the minilab for this activity. TLW complete their science notebook pages for section 1.2. TLW complete 1.2 assessment handout for a grade.	
Closure		TTW discuss the mini lab "Debunking Astrology" with students and inform them that all of the horoscopes were from the same sign.

Accommodations		Accomodations from IEPs will be included once they have been provided. SD (have not received IEP)
Lesson Line	**Time**	**Day / Date:** Thursday August 1 6, 2012
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem #4 Unit 1 from MS Biology Test Prep book. TLW analyze the bellringer and submit their answer in written form using prior knowledge. TTW discuss the possible choices and discuss with TL why an option is or is not the correct answer.
Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display the vocabulary words observation, inference, scientific method, hypothesis, serendipity, experiment, control group, experimental group, independent variable, dependent variable, constant, data, safety symbol. TLW complete the vocabulary portion of their science notebook activity where they use the words in contextual format. Review vocabulary word: investigation TTW call on students to share and explain their answers with the class.
Hook/Set (Focus student attention)		TTW ask students what they do to find answers to questions. Do they ask other people, read, invetigage, or observe? Are their methods haphazard or methodical? TLW respond to teacher questioning. TTW explain that over time, scientists have established standard procedures to find answers to questions called the scientific method. TTW show a brainpop on the scientific method. TLW watch the brainpop and answer questions about the brainpop when called upon by TT.
Modeling (Teaching of Lesson)		TTW display the interactive powerpoint presentation "Methods of Science" and discuss the process by which science in conducted. TTW randomly call on students throughout the presentation to check for understanding.

Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		TLW complete sections of their science interactive notebook throughout the lesson (ex. TTW teach a portion of the information and the student will examine the textbook for that section to answer the questions in their notebook incorporating common core principals). TTW discuss the science notebook sections with the class by randomly calling on students to check for answers. TT and TL will complete Scientific Method in Action which analyzes the first two parts of the scientific method (problem and hypothesis) TL read the case aloud when called upon and the class will work through the questions together. TT and TL will work through the handout experimental design and graphing to identify independent and dependent variables.
Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**		TLW complete Mythbusters scientific method handout. They will watch two clips from mythbusters and follow the scientific method to answer the questions. TLW work in pairs to complete Manipulate Variable MiniLab where they will complete a printed maze and then manipulate experimental variables to complete the maze again. Results will be recorded and questions about the scientific method will be answed. TLW complete the Real-World Biology Analysis handout, "Applying Scientific Methods"
Closure		TTW discuss the mini lab "Manipulate Variables"
Accommodations		Accomodations from IEPs will be included once they have been provided. SD (have not received IEP)
Lesson Line	**Time**	**Day / Date:** Friday August 1 7, 2012
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem #5 Unit 1 from MS Biology Test Prep book. TLW analyze the bellringer and submit their answer in written form using prior knowledge. TTW discuss the possible choices and discuss with TL why an option is or is not the correct answer.

Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display the vocabulary words observation, inference, scientific method, hypothesis, serendipity, experiment, control group, experimental group, independent variable, dependent variable, constant, data, safety symbol. TLW complete the vocabulary portion of their science notebook activity where they use the words in contextual format. Review vocabulary word: investigation TTW call on students to share and explain their answers with the class.
Hook/Set (Focus student attention)		TTW ask students to help create a survey with questions such as "what is your favorite film". Survey the class and write answers on the board. TLW provide questions and answers. TTW explain that this is called data and data is analyzed to explain many different trends such a the #1 movie, the best song, etc. Just like data is used to determine the #1 in social media, data is also used to determine and explain the results of a scientific experiment. Collecting and analyzing data is a part of the scientific method.
Modeling (Teaching of Lesson)		TTW display the interactive powerpoint presentation "Methods of Science" part 2 and discuss the process by which science in conducted. TTW randomly call on students throughout the presentation to check for understanding.
Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		TLW complete sections of their science interactive notebook throughout the lesson (ex. TTW teach a portion of the information and the student will examine the textbook for that section to answer the questions in their notebook incorporating common core principals). TTW discuss the science notebook sections with the class by randomly calling on students to check for answers. TT and TL will discuss and complete the handout "Analyzing Data," "Analysis Skill," and "Interpreting Graphs" throughout the lesson.

Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**	TLW complete the Design your Own Bio Lab, "How can you keep cut flowers fresh." This lab incorporates the use of the scientific method as well as critical thinking skills to design their own experiment using the required steps of the scientific method (level 2 design--some guidance is given). TLW complete 1.3 assessment for a daily grade.	
Closure		TTW give students an example of an experiment and have them identify the parts of the scientific method as it relates to the example.
Accommodations		Accomodations from IEPs will be included once they have been provided. SD (have not received IEP)

PUBLIC PLAN (EX. HOMEWORK)

None

RESOURCES (FOR REFERENCE ONLY)

Biology I text MS Test Prep Book (Holt) The Martian and the Car handout from biologycorner.com Science Interactive Notebook Mini Lab 1.1 Debunking Astrology mini lab

EVALUATIONS (FOR REFERENCE ONLY)

informal observations through class lecture formal observations including daily assignments

OTHER OBJECTIVES (FOR REFERENCE ONLY)

TLW define biology. TLW identify possible benefits from studying biology. TLW summarize the characteristics of living things. TLW explain the characteristics of science. TLW compare something that is scientific with something that is pseudoscience. TLW describe the importance of the metric system and SI. TLW describe the difference between an observation and an inference. TLW differentiate among control, independent variable, and dependent variable. TLW identify the scientific methods a biology uses for research.

APPENDIX I

EXEMPLARY SCIENCE TEACHER LESSON PLAN—MEDIUM STATUS

Ownership (Group Edit)

No Group Edit/Ownership

Title:

Chapter 3 Test/Chapter 4

Subject: Biology I

Start Date:

10/01/2012

End Date:

10/05/2012

Show Only Standards for:

Not Specified

Covered Standards:

Use Ctrl/Cmd + Click to select multiple standards from list

[BI.1.e.] Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)

[BI.3] Investigate and evaluate the interaction between living organisms and their environment.

[BI.3.a.] Compare and contrast the characteristics of the world's major biomes (e.g., deserts, tundra, taiga, grassland, temperate forest, tropical rainforest). (DOK 2)

[BI.3.a.1] Plant and animal species [BI.3.a.2] Climate (temperature and rainfall) [BI.3.a.3] Adaptations of organisms

[BI.3.b.] Provide examples to justify the interdependence among environmental elements. (DOK 2)

[BI.3.b.1] Biotic and abiotic factors in an ecosystem (e.g., water, carbon, oxygen, mold, leaves)

[BI.3.c.] Examine and evaluate the significance of natural events and human activities on major ecosystems (e.g., succession, population growth, technology, loss of ge

PRIVATE PLAN DETAILS

Lesson Line	Time	Day / Date: Monday, October 1, 2012
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem from chapter 3 ppt resources. TLW analyze the bellringer and submit their answer in written form using prior knowledge.
Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display all chapter 3 vocabulary. TLW explain what each term means when called upon.
Hook/Set (Focus student attention)		TTW show a brain pop cartoon on ecosystems. TLW analyze the video and complete a 10 question quiz that will be led by a class volunteer.
Modeling (Teaching of Lesson)		TTW review key concepts from chapter 3 through an interactive presentation.
Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		TT and TLW play a few animated games on the smartboard to review key concepts from the chapter.
Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**	TLW complete chapter 3 notebook pages. TLW complete chapter 3 study guide with a partner.	
Closure		TTW answer any test related questions.

Accommodations		SD `Assignments read in resource `Tests read in resource `Extended time for homework assignments (specified by resource) `Extended time for tests (specified by resource) `Explain directions and give concrete/visual examples. `Give verbal directions in sequential steps `Frequent reinforcement of previously mastered skills `Provide encouragement and rewards

Lesson Line	Time	Day / Date: Tuesday, October 2, 2012
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem from chapter 3 ppt resources. TLW analyze the bellringer and submit their answer in written form using prior knowledge.
Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display all chapter 3 vocabulary. TLW explain what each term means when called upon.
Hook/Set (Focus student attention)		TTW display a brainpop cartoon titled biomes. TLW answer the ten question quiz led by a student volunteer
Modeling (Teaching of Lesson)		TTW review key concepts from chapter 3.
Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		TT will answer any test related questions.

Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**	TLW complete chapter 3 test. TLW make corrections to benchmark test #1. TLW begin chapter 4 notebook pages.	
Closure		Discuss any test related questions.
Accommodations		SD `Assignments read in resource `Tests read in resource `Extended time for homework assignments (specified by resource) `Extended time for tests (specified by resource) `Explain directions and give concrete/visual examples. `Give verbal directions in sequential steps `Frequent reinforcement of previously mastered skills `Provide encouragement and rewards

Lesson Line	Time	Day / Date: Wednesday, October 3, 2012
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem from chapter 3 ppt resources. TLW analyze the bellringer and submit their answer in written form using prior knowledge.
Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display the words from chapter 4.1 including population density, dispersion, density-independent factor, density-dependent factor, population growth rate, emigration, immigration, carrying capacity. TLW explain to the teacher what they think each term means or give an example of each term.

Hook/Set (Focus student attention)		TTW display a brain pop cartoon titled "population" TLW analyze the cartoon and complete a student led ten question quiz.
Modeling (Teaching of Lesson)		TTW introduce 4.1 population dynamics through an interactive presentation.
Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		TLW complete a note-taking sheet throughout the interactive presentation.
Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**	TLW complete ch 3 test revisions review. TLW complete 4.1 notebook.	
Closure		TLW write down one example of a density-independent factor that has been observed in class activities.
Accommodations		SD `Assignments read in resource `Tests read in resource `Extended time for homework assignments (specified by resource) `Extended time for tests (specified by resource) `Explain directions and give concrete/visual examples. `Give verbal directions in sequential steps `Frequent reinforcement of previously mastered skills `Provide encouragement and rewards

Lesson Line	Time	Day / Date: Thursday, October 4, 2012
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem from chapter 4 ppt resources. TLW analyze the bellringer and submit their answer in written form using prior knowledge.
Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display the words from chapter 4.1 including population density, dispersion, density-independent factor, density-dependent factor, population growth rate, emigration, immigration, carrying capacity. TLW explain to the teacher the meaning of each term.
Hook/Set (Focus student attention)		TTW display the cartoon from study jams titled "population growth" TLW analyze the cartoon and answer a 7 question student led quiz.
Modeling (Teaching of Lesson)		TTW review 4.1 through an interactive presentation.
Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		TT and TLW review the procedures for the activity titled "O'Deer" TT and TLW record and discuss the data from the activity.
Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**	TLW complete the outside activity "O'Deer" TLW graph the data and complete a series of analysis questions.	
Closure		TT and TLW discuss the the closure questions and determine the carrying capacity as well as limiting factors for the simulation.

Accommodations			SD `Assignments read in resource `Tests read in resource `Extended time for homework assignments (specified by resource) `Extended time for tests (specified by resource) `Explain directions and give concrete/visual examples. `Give verbal directions in sequential steps `Frequent reinforcement of previously mastered skills `Provide encouragement and rewards

Lesson Line	**Time**	**Day / Date: Friday, October 5, 2012**
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem from chapter 4 ppt resources. TLW analyze the bellringer and submit their answer in written form using prior knowledge.
Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display the words from chapter 4.1 including demography, demographic transition, zero population growth (ZPG), and age structure. TLW explain to the teacher what they think each term means or give an example of each term.
Hook/Set (Focus student attention)		Discuss with students that depending on where you live depends on your perception of population growth. Ask them if they think the growth rate was faster 50 years ago or today. Show students population data for Clarke County to discuss the answers.
Modeling (Teaching of Lesson)		TTW introduce 4.2 through an interactive presentation.
Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		TLW complete a note-taking sheet as TT models 4.2 through an interactive presentation. TT and TLW discuss analyzing population data handout and complete as a whole class.

Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**	TLW complete 4.2 notebook pages. TLW complete a study guide for chapter 4.	
Closure		TLW summarize key aspects of human population data.
Accommodations		SD `Assignments read in resource `Tests read in resource `Extended time for homework assignments (specified by resource) `Extended time for tests (specified by resource) `Explain directions and give concrete/visual examples. `Give verbal directions in sequential steps `Frequent reinforcement of previously mastered skills `Provide encouragement and rewards

PUBLIC PLAN (EX. HOMEWORK)

OTHER OBJECTIVES (FOR REFERENCE ONLY)

TLW review key topics from Chapter 3 to prepare for unit test. TLW describe characteristics of populations. TLW understand the concepts of carrying capacity and limiting factors. TLW describe the ways in which populations are distributed. TLW explain the trends in human population growth. TLW compare the age structure of representative nongrowing, slowly growing, and rapidly growing countries. TLW predict the consequences of continued population growth.

APPENDIX J

EXEMPLARY SCIENCE TEACHER LESSON PLAN—LOW STATUS

Ownership (Group Edit)

No Group Edit/Ownership

Title:

Chapter 2

Subject: Biology I

Start Date:

09/10/2012

End Date:

09/14/2012

Show Only Standards for:

Not Specified

Covered Standards:

Use Ctrl/Cmd + Click to select multiple standards from list

[BI.1.1] Apply inquiry-based and problem-solving processes and skills to scientific investigations.
[BI.1.a.] Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
[BI.1.a.2] Proper use and care of the compound light microscope, slides, chemicals, etc.
[BI.1.a.3] Accuracy and precision in using graduated cylinders, balances, beakers, thermometers, and rulers
[BI.1.c.] Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, d
[BI.1.e.] Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
[BI.3] Investigate and evaluate the interaction between living organisms and their environment.
[BI.3.b.2] Energy flow in ecosystems (e.g., energy pyramids and photosynthetic organisms to herbivores, carnivores, and decomposers)
[BI.3.b.4] Interrelationships of organisms (e.g., cooperation, predation, parasitism, commensalism, symbiosis, and mutualism)

PRIVATE PLAN DETAILS

Lesson Line	Time	Day / Date: Monday September 10, 2012
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem from chapter 2 ppt resources. TLW analyze the bellringer and submit their answer in written form using prior knowledge. TTW discuss the possible choices and discuss with TL why an option is or is not the correct answer.
Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display the words TTW call on students to explain the meaning of each word.
Hook/Set (Focus student attention)		TTW display video clips from national geographic for the food chain activity.
Modeling (Teaching of Lesson)		TTW review food chains and energy pyramids via an interactive presentation.
Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		TTW explain the food chain activity from thinkfinity and answer any student questions.
Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**	TLW complete the food chain activity from thinkfinity.	
Closure		TTW summarize the components of a food chain/web.

Accommodations		SD `Assignments read in resource `Tests read in resource `Extended time for homework assignments (specified by resource) `Extended time for tests (specified by resource) `Explain directions and give concrete/visual examples. `Give verbal directions in sequential steps `Frequent reinforcement of previously mastered skills `Provide encouragement and rewards
Lesson Line	**Time**	**Day / Date:** Tuesday, September 11, 2012
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem from chapter 2 ppt resources. TLW analyze the bellringer and submit their answer in written form using prior knowledge. TTW discuss the possible choices and discuss with TL why an option is or is not the correct answer.
Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display the words TTW call on students to explain the meaning of each word.
Hook/Set (Focus student attention)		TTW show the study jams cartoon on food webs.
Modeling (Teaching of Lesson)		TTW discuss key concepts from 2.3 via an interactive presentation.
Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		TTW and TLW complete smartboard mini games for each of the three cycles.

Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**	TLW complete comprehension handouts on the three cycles from edheads.com with a partner. TLW complete a grades handout identifying key concepts of each cycle.	
Closure		TTW discuss reading comprehension handouts with students.
Accommodations		SD `Assignments read in resource `Tests read in resource `Extended time for homework assignments (specified by resource) `Extended time for tests (specified by resource) `Explain directions and give concrete/visual examples. `Give verbal directions in sequential steps `Frequent reinforcement of previously mastered skills `Provide encouragement and rewards

Lesson Line	**Time**	**Day / Date:** Wednesday, September 12, 2012 Sub due to SATP tutoring
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem from chapter 2 ppt resources. TLW analyze the bellringer and submit their answer in written form using prior knowledge. TTW discuss the possible choices and discuss with TL why an option is or is not the correct answer.
Word Wall Essential vocabulary, Word of Day, Academic vocabulary		All words for Chapter 2 are displayed on the word wall. TLW complete vocabulary section of 2.3 notebook to review key terms.

Hook/Set (Focus student attention)		Substitute will explain activities.
Modeling (Teaching of Lesson)		Substitute will explain activities.
Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		Substitute will help students as needed.
Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**	TLW complete the 2.3 notebook. TLW complete chapter 2 study guide.	
Closure		Substitute will discuss answers to the study guide (via teacher key).
Accommodations		SD \`Assignments read in resource \`Tests read in resource \`Extended time for homework assignments (specified by resource) \`Extended time for tests (specified by resource) \`Explain directions and give concrete/visual examples. \`Give verbal directions in sequential steps \`Frequent reinforcement of previously mastered skills \`Provide encouragement and rewards

Lesson Line	Time	Day / Date: Thursday, September 13, 2012
Bell Ringer (New skill or previously learned skill)		TTW display SATP practice problem from chapter 2 ppt resources. TLW analyze the bellringer and submit their answer in written form using prior knowledge.
Word Wall Essential vocabulary, Word of Day, Academic vocabulary		TTW display the words from chapter 2. TTW play a quick review game with the students to prepare for the test.
Hook/Set (Focus student attention)		Study Jams video quizzes (from the videos watched during the chapter.
Modeling (Teaching of Lesson)		TTW review key concepts from chapter 2.
Guided Practice (Students practice with teacher help) Can also be independent work with immediate feedback		TTW answer any student questions about chapter 2.
Independent Practice (Students applying lesson objective • **Groups** • **Learning Station** • **Individual** • **Pairs**	TLW complete test for chapter 2. TLW begin chapter 3 notebook.	
Closure		TTW answer any test related questions.

Accommodations		SD `Assignments read in resource `Tests read in resource `Extended time for homework assignments (specified by resource) `Extended time for tests (specified by resource) `Explain directions and give concrete/visual examples. `Give verbal directions in sequential steps `Frequent reinforcement of previously mastered skills `Provide encouragement and rewards

Friday we will complete test revisions and review chapter 2 using SATP practice book.

PUBLIC PLAN (EX. HOMEWORK)

OTHER OBJECTIVES (FOR REFERENCE ONLY)

TLW describe the flow of energy through an ecosystem. TLW identify the ultimate energy source for photosynthetic producers. TLW describe food chains, food webs, and pyramid models.